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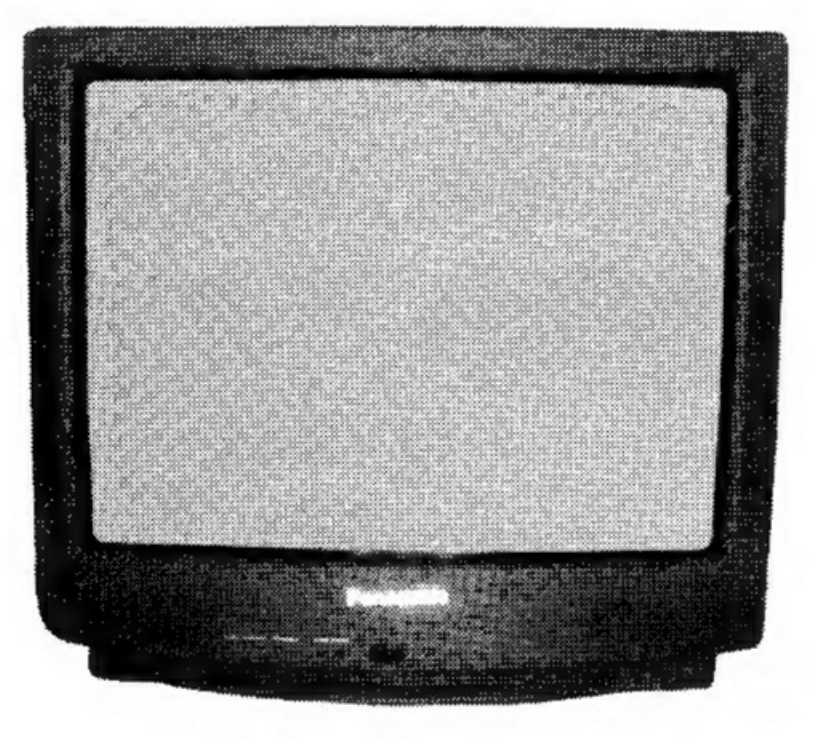
PANASONIC CT-13R31B SERVICE MANUAL



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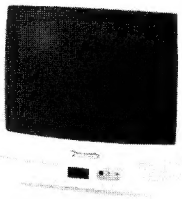
Service Manual

Color Television

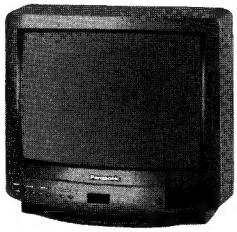
Main Manual
(NA6LV)

CT-13R31B
CT-13R31CB

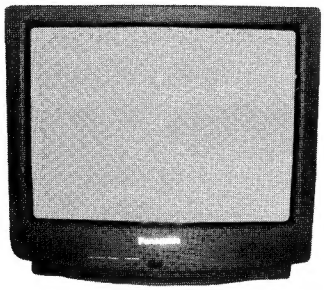


CT-13R41B
CT-13R41CB

CT-13R51DB



CT-13R5B



CT-27G5B

Panasonic

Models	Chassis
CT-13R31B	MGP328
CT-13R31CB	MGP328
CT-13R41B	MGP328
CT-13R41CB	MGP328
CT-13R51DB	MHP328
CT-13R5B	MQP328
CT-27G5B	GP325
CT-27G5CB	GP325
CT-27G5UB	GP325

This Service manual is issued as a service guide for the models of the **NA6LV** family listed above. Included in this manual are a set of schematics, block diagrams, functional descriptions, alignment procedures, disassembly procedures, and a complete parts list.

"**WARNING!** This Service Manual is designed for experienced repair technicians only and is not designed for use by the general public. It does not contain warnings or cautions to advise non-technical individuals of potential dangers in attempting to service a product. **Products powered by electricity should be serviced or repaired only by experienced professional technicians.** Any attempt to service or repair the product or products dealt with in this Service Manual by anyone else could result in serious injury or death."

The service technician is required to read and follow the "**Safety Precautions**" and "**Important Safety Notice**" in this Main Manual.

Panasonic®

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Important Safety Notice

Special components are used in this television set which are important for safety. These parts are identified on the schematic diagram by the symbol ⚠ and printed in **BOLD TYPE** on the replacement part list. It is essential that these critical parts are replaced with the manufacturer's specified replacement part to prevent X-ray radiation, shock, fire or other hazards. Do not modify the original design without the manufacturer's permission.

Safety Precautions

General Guidelines

An **Isolation Transformer** should always be used during the servicing of a receiver whose chassis is not isolated from AC power line. Use a transformer of adequate power rating as this protects the technician from accidents resulting in personal injury from electrical shocks. It will also protect the Receiver from being damaged by accidental shorting that may occur during servicing.

When servicing, observe the original lead dress, especially in the high voltage circuit. Replace all damaged parts (also parts that show signs of overheating.)

Always Replace Protective Devices, such as fishpaper, isolation resistors and capacitors, and shields after servicing the Receiver. Use only manufacturer's recommended rating for fuses, circuits breakers, etc.

High potentials are present when this Receiver is operating. Operation of the Receiver without the rear cover introduces danger for electrical shock. Servicing should not be performed by anyone who is not thoroughly familiar with the necessary precautions when servicing high-voltage equipment.

Extreme care should be practiced when **Handling the Picture Tube**. Rough handling may cause it to implode due to atmospheric pressure. (14.7 lbs per sq. in.). Do not nick or scratch the glass or subject it to any undue pressure. When handling, use safety goggles and heavy gloves for protection. **Discharge the picture tube** by shorting the anode to chassis ground (not to the cabinet or to other mounting hardware). When discharging connect cold ground (i.e. dag ground lead) to the anode with a well insulated wire or use a grounding probe.

Avoid prolonged exposure at close range to unshielded areas of the picture tube to prevent exposure to X-ray radiation.

The **Test Picture Tube** used for servicing the chassis at the bench should incorporate safety glass and magnetic shielding. The safety glass provide shielding for the tube viewing area against X-ray radiation as well as implosion. The magnetic shield limits the X-ray radiation around the bell of the picture tube in addition to the restricting magnetic effects. When using a picture tube test jig for service, ensure that the jig is capable of handling **37.69kV** without causing X-ray radiation.

Before returning a serviced receiver to the owner, the service technician must thoroughly test the unit to ensure that is completely safe to operate. **Do not use a line isolation transformer when testing.**

Leakage Current Cold Check

Unplug the AC cord and connect a jumper between the two plug prongs.

Measure the resistance between the jumpered AC plug and expose metallic parts such as screwheads, antenna terminals, control shafts, etc. If the exposed metallic part has a return path to the chassis, the reading should be between 240kΩ and 5.2MΩ. If the exposed metallic part does not have a return path to the chassis, the reading should be infinite.

Leakage Current Hot Check (Fig. 1)

Plug the AC cord directly into the AC outlet. Do not use an isolation transformer during the check.

Connect a 1.5kΩ 10 watt resistor in parallel with a 0.15μF capacitor between an exposed metallic part and ground. Use earth ground, for example a water pipe.

Using a DVM with a 1000 ohms/volt sensitivity or higher, measure the AC potential across the resistor.

Repeat the procedure and measure the voltage present with all other exposed metallic parts.

Verify that any potential does not exceed 0.75 volt RMS. A leakage current tester (such a Simpson Model 229, Sencore Model PR57 or equivalent) may be used in the above procedure, in which case any current measure must not exceed 1/2 milliamp. If any measurement is out of the specified limits, there is a possibility of a shock hazard and the Receiver must be repaired and rechecked before it is returned to the customer.

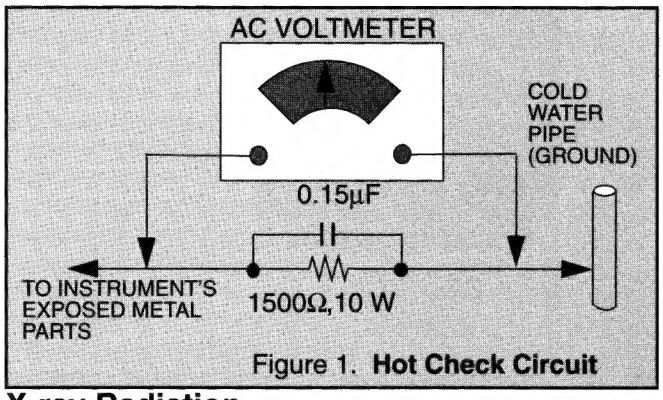

Figure 1. **Hot Check Circuit**

X-ray Radiation

WARNING: The potential source of X-ray radiation in the TV set is in the High Voltage section and the picture tube.

Note: *It is important to use an accurate, calibrated high voltage meter.*

Set the **brightness, picture, sharpness** and **color** controls to Minimum. Measure the High Voltage. The high voltage should be **23.75kV ± 1.25kV** for 13" models and **29.25kV ± 1.25kV** for 27" models. If the upper limit is out of tolerance, immediate service and correction is required to insure safe operation and to prevent the possibility of premature component failure.

Horizontal Oscillator Disable Circuit Test

This test must be performed as a final check before the Receiver is returned to the customer. See Horizontal **Oscillator Disable Circuit Procedure Check** in this manual.

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P-Board **Sheet-2B**

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Service Notes

Note: ***These components are affixed with glue. Be careful not to break or damage any foil under the component or at the pins of the ICs when removing. Usually applying heat to the component for a short time while twisting with tweezers will break the component loose.***

Leadless Chip Component (surface mount)

Chip components must be replaced with identical chips due to critical foil track spacing. There are no holes in the board to mount standard transistors or diodes. Some chips capacitor or resistor board solder pads may have holes through the board, however the hole diameter limits standard resistor replacement to 1/8 watt. Standard capacitor may also be limited for the same reason. It is recommended that identical components be used.

Chip resistor have a three digit numerical resistance code - 1st and 2nd significant digits and a multiplier. Example: 162 = 1600 or 1.6kΩ resistor, 0 = 0Ω (jumper).

Chip capacitors generally do not have the value indicated on the capacitor. The color of the component indicates the general range of the capacitance.

Chip transistors are identified by a two letter code. The first letter indicates the type and the second letter, the grade of transistor.

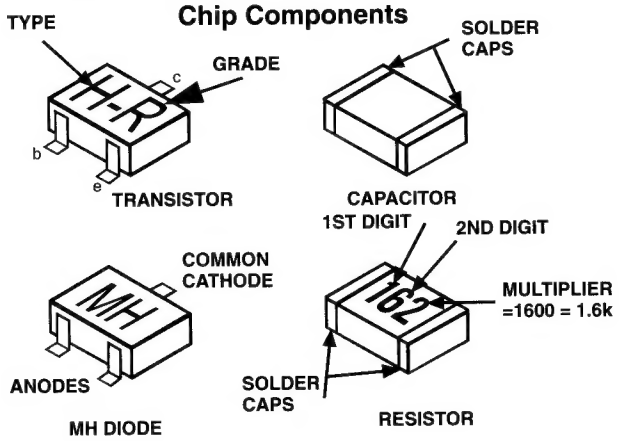
Chip diodes have a two letter identification code as per the code chart and are a dual diode pack with either common anode or common cathode. Check the parts list for correct diode number.

Component Removal

1. Use solder wick to remove solder from component end caps or terminal.
2. Without pulling up, carefully twist the component with tweezers to break the adhesive.
3. Do not reuse removed leadless or chip components since they are subject to stress fracture during removal.

Chip Component Installation

1. Put a small amount of solder on the board soldering pads.
2. Hold the chip component against the soldering pads with tweezers or with a miniature alligator clip and apply heat to the pad area with a 30 watt iron until solder flows. Do not apply heat for more than 3 seconds.

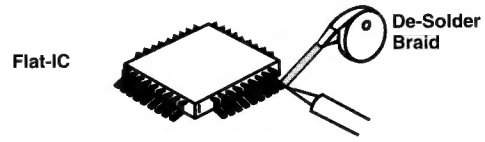


How to Replace Flat-IC

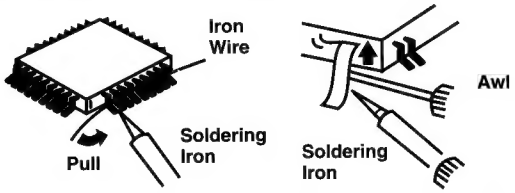
- Required Tools -

- Soldering iron
- De-solder braids
- Iron wire or small awl
- Magnifier

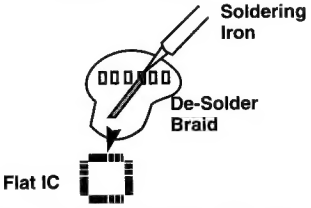
1. Remove the solder from all of the pins of a Flat-IC by using a de-solder braid.



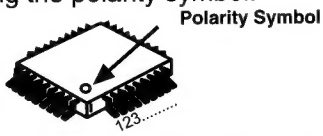
2. Put the iron wire under the pins of the Flat-IC and pull it in the direction indicated while heating the pins using a soldering iron. A small awl can be used instead of the iron wire.



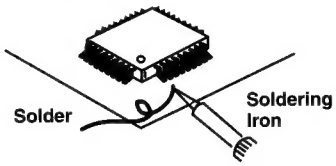
3. Remove the solder from all the pads of the Flat-IC by using a de-solder braid.



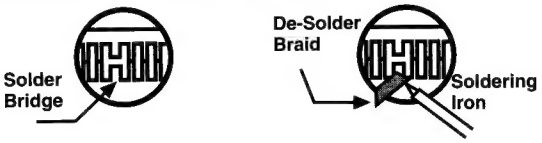
4. Position the new Flat-IC in place (apply the pins of the Flat-IC to the soldering pads where the pins need to be soldered). Properly determine the positions of the soldering pads and pins by correctly aligning the polarity symbol.



5. Solder all pins to the soldering pads using a fine tipped soldering iron.



6. Check with a magnifier for solder bridge between the pins or for dry joint between pins and soldering pads. To remove a solder bridge, use a de-solder braid as shown in the figure below.



Service Notes (Continued)

IMPORTANT: To protect against possible damage to the solid state devices due to arcing or static discharge, make certain that all ground wires and CTR DAG wire are securely connected.

CAUTION: The power supply circuit is above earth ground and the chassis cannot be polarized. Use an isolation transformer when servicing the Receiver to avoid damage to the test equipment or to the chassis. Connect the test equipment to the proper ground (⏚) or (⏚) when servicing, or incorrect voltages will be measured.

WARNING: This Receiver has been designed to meet or exceed applicable safety and X-ray radiation protection as specified by government agencies and independent testing laboratories.

To maintain original product safety design standards relative to X-ray radiation and shock and fire hazard, parts indicated with the symbol ⚠ on the schematic must be replaced with identical parts. Order parts from the manufacturer's parts center using the parts numbers shown in this service manual, or provide the chassis number and the part reference number.

For optimum performance and reliability, all other parts should be replaced with components of identical specification.

Horizontal Oscillator Disable Circuit

This chassis employs a special circuit to protect against excessive high voltage and beam current. If, for any reason, the high voltage and beam current exceed a predetermined level this protective circuit activates and detunes the horizontal oscillator that limits the high voltage. The over-voltage protection circuit is not adjustable. However, if components indicated by the symbol ⚠ on the schematic in either the horizontal sweep system or the over-voltage protection circuit itself are changed, the operation of the circuit should be checked using the following procedure:

Equipment needed to check the disabled circuit:

1. Voltmeter (0 - 200V scale)
2. High Voltage Meter (0- 50kV)
3. Variac or Isolation Transformer

Procedure:

1. Tune in a station to verify that the horizontal is in sync.
2. Obtain a Monoscope pattern or a signal generator crosshatch pattern
3. Connect the voltmeter (-) lead to TPD2 and the (+) lead to TPD1 (junction of D555 anode, R556 & R557). Set **Bright** level to (0) and **Picture** for a 1.8 volt reading on the voltmeter.
4. Turn the Receiver OFF. Connect a jumper across IC803 pin 3 and pin 4. Apply +9V DC to cathode of D001.
5. Reduce the AC supply voltage to approximately 45V. Connect the high voltage meter to the CRT anode. (H.V. button).

Note: *Use the Dag Ground (C10 on the CRT Board) to connect the (-) lead of the meter.*

6. Turn the Receiver ON. Slowly increase the AC supply voltage and verify that the high voltages does not exceed **27.9kV** for 13" models and **37.1kV** for 27" models when horizontal; just begins to pull out of sync. If the high voltage is not within the specified limit, the cause must be determined and corrected before the Receiver is returned to the customer.

Receiver Feature Table

FEATURE\MODEL	CT-13R51DB	CT-13R31B/CB, CT-13R41B/CB	CT-13R5B	CT-27G5B/CB/UB
Chassis	NA6LV	NA6LV	NA6LV	NA6LV
Tunning system	40K	40K	40K	40K
# of channels	181	181	181	181
Menu language	Eng/Span/Fr	Eng/Span/Fr	Eng/Span/Fr	Eng/Span/Fr
Closed Caption	X	X	X	X
V-Chip	X	X	X	X
75 Ω input	X	X	X	X
Remote Model #	EUR501450	SEE NOTE BELOW[I]	EUR501452	EUR501450
Picture tube	37GDA85X(M)	37GDA85X(M)	37GDA85X(M)	M68LGL061X
Notch filter	P	P	P	P
V/A norm	V	V	V	V
AI Sound	--	--	--	X
Built-in audio power	1.5W (10%)	1.5W (10%)	1.5W (10%)	1.5Wx2 (10%)
# of speakers	1	1	1	2
A/V in (rear/front)	1/1	1/1	--	1/0
EPJ/HPJ/MISC	EPJ	EPJ	EPJ	--
Dimensions mm (WxDxH) in	359x384x343 13.71x15.09x13.47	359x384x343 13.71x15.09x13.47	359x384x343 13.71x15.09x13.47	600x665x634 23.62x26.18x24.96
Weight (kg/lbs)	10.21/22.46	9.23/20.30	9.23/20.30	34.25/75.35
Power source (V/Hz)	120/60 AC 12V DC	120/60	120/60	120/60
Anode voltage	23.75kV ± 1.25kV	23.75kV ± 1.25kV	23.75kV ± 1.25kV	29.25kV ± 1.25kV
Video input jack	$1V_{p-p}$ 75Ω, phono jack	$1V_{p-p}$ 75Ω, phono jack	$1V_{p-p}$ 75Ω, phono jack	$1V_{p-p}$ 75Ω, phono jack
Audio input jack	500mV RMS 47kΩ	500mV RMS 47kΩ	500mV RMS 47kΩ	500mV RMS 47kΩ
A-Board TNP2AH020	EH	EG	EF	--
A-Board TNP2AH018	--	--	--	BS
C-Board TNP2AA064	AC	AC	AC	--
C-Board TNP2AA062	--	--	--	AC
P-Board TNP2AA014	NIL	--	--	--
J-Board 0NP19052	--	--	AE	--

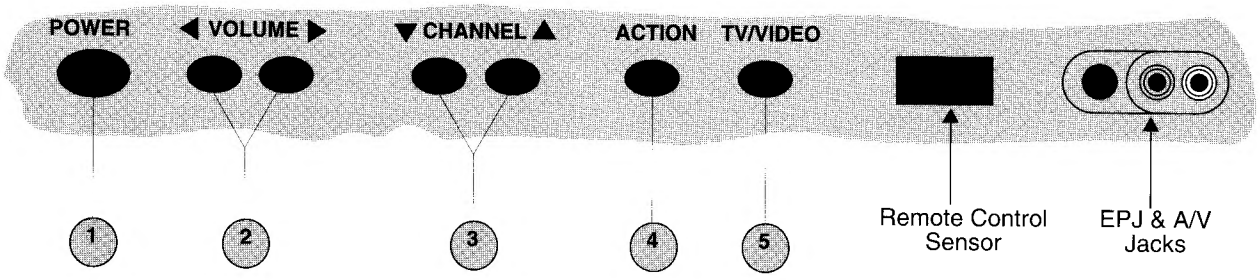
Table 1. **Receiver Features**

I. NOTE: For CT-13R31B/CB, Model: EUR501450 and for CT-13R41B/CB, Model: EUR501451.

Specifications are subject to change without notice or obligation.
Dimensions and weights are approximate.

Location of Controls (Receiver)

Figure 2. **Location of Controls (Receiver, typical 13").**



Quick Reference Control Operation

Quick Reference Control Operation	
1	**Power Button -** Press to turn ON or OFF.
2	**Volume Buttons -** Press to adjust Sound Level, or to adjust Audio Menus, Video Menus, and select operating features when menus are displayed
3	**Channel Buttons -** Press to select programmed channels. Press to highlight desired features when menus are displayed. Also use to select Cable Converter box channels after programming Remote Control Infra-red codes (the TV/AUX/CABLE switch must be set in CABLE position).
4	**Action Button -** Press to display Main Menu and access On Screen feature and Adjustment Menus.
5	**TV/Video Button -** Press to select TV or Video Input.

Location of Controls (Remote)

Power Button
Press to turn ON and OFF.
Mute Button
Press to mute sound. A second press resumes sound. Press also to access and delete Closed Caption display.
Volume Buttons
Press to adjust TV sound level. Use with Channel buttons to navigate in menus.
Channel Buttons
Press to select channels. Use with volume buttons to navigate in menus.
Action Button
Press to display Main Menu and access or exit On Screen features and Adjustment Menus.
Keypad Buttons
Press desired channel number to randomly access any channel.
R-Tune (Rapid Tune) Button.
Press to switch to the previous channel.
Recall Button
Press to display Time, status of Sleep Timer, Channel, Video mode and Channel Caption (Station Identifier).

EUR501452
CT-13R5B

Figure 3. **Location of Controls (Remote).**

Location of Controls (Remote) Cont.

Power Button
Press to turn ON and OFF.
Mute Button
Press to mute sound. A second press resumes sound. Press also to access and delete Closed Caption display.
TV/Video Button
Press to select TV or Video input.
Volume Buttons
Press to adjust TV sound level. Use with Channel buttons to navigate in menus.
Channel Buttons
Press to select channels. Use with volume buttons to navigate in menus.
Action Button
Press to display Main Menu and access or exit On Screen features and Adjustment Menus.
Keypad Buttons
Press desired channel number to randomly access any channel.
R-Tune (Rapid Tune) Button.
Press to switch to the previous channel.
Recall Button
Press to display Time, status of Sleep Timer, Channel, Video mode and Channel Caption (Station Identifier).

EUR501450
CT-13R31B/CB,
CT-13R51DB, &
CT-27G5B/CB/UB

Figure 4. **Location of Controls (Remote)**.

NOTE:
Remote **EUR501451** (for CT-13R41B/CB) is similar to EUR501450, but is **WHITE** in color.

Disassembly for Service

Back Cover

Remove all the screws marked with an arrow(◄) from the back of the Receiver.

Note: *Screw configuration, type, and number of screws vary depending on the model of the Receiver serviced and the application; various models are covered in this Manual. Use same hardware when reassembling the receiver.*

- 2 screws at the top edge of the Receiver.
- 1 screw at the bottom edge of the Receiver.
- 1 screw by the AC cord assembly.
- 1 screw by the A/V jacks.
- 1 screw by the Fly-back assembly.

A-Board - Main Chassis

1. Slide the chassis completely out of the guide rails.
2. Stand the Receiver on its edge. The underside of the board is completely accessible for component replacement.

Note: *Some tie-wraps that secure the wire dressings may need to be unfastened for chassis removal.*

C-Board - CRT Output

Plugs into the socket on the CRT neck.

Speakers

Speaker is secured to the cabinet's front with 4 screws.

Keyboard Push Button Assembly

Fastened to the inside of the cabinet front with up to 3 screws.

Disassembly for CRT Replacement

1. Discharge the CRT as instructed in the **Safety Precautions** (see page 2).
2. Disconnect the yoke (DY) plug, degaussing coil (DEG) plug and the CRT 2nd anode button from the main board.
3. Remove the C-Board from the CRT base and unplug the black wire (CRT dag ground) C10.
4. Disconnect the A11, A12, and Speakers plugs from the A-Board.
5. Lift the Main Chassis (A-Board) and all mounted boards completely out with the CRT Board attached.

CRT Replacement

1. Perform **Disassembly for CRT Replacement** procedure.
2. Insure that the CRT H.V. Anode button is discharged before handling the CRT. Read the **Safety Precautions** (see page 2) on handling the picture tube.
3. Remove the components from the CRT neck and place the cabinet face down on a soft pad.
4. Note the original order for the CRT mounting hardware as they are remove from the CRT mounting brackets at each corner of the CRT.
5. Remove the CRT with the degaussing coil and the dag ground braid attached.
6. Note the original locations and mounting of the degaussing coil and the dag ground assembly to insure proper reinstallation on the replacement CRT.

   To remove and re-mount the degaussing coil: The degaussing coil is held in place by clampers fastened to the CRT corner ears. These clampers must be installed onto the replacement CRT prior to mounting the degaussing coil.

   To remove and re-mount the dag ground braid:

   a. Unhook the coil spring from the bottom corners of the CRT ears.

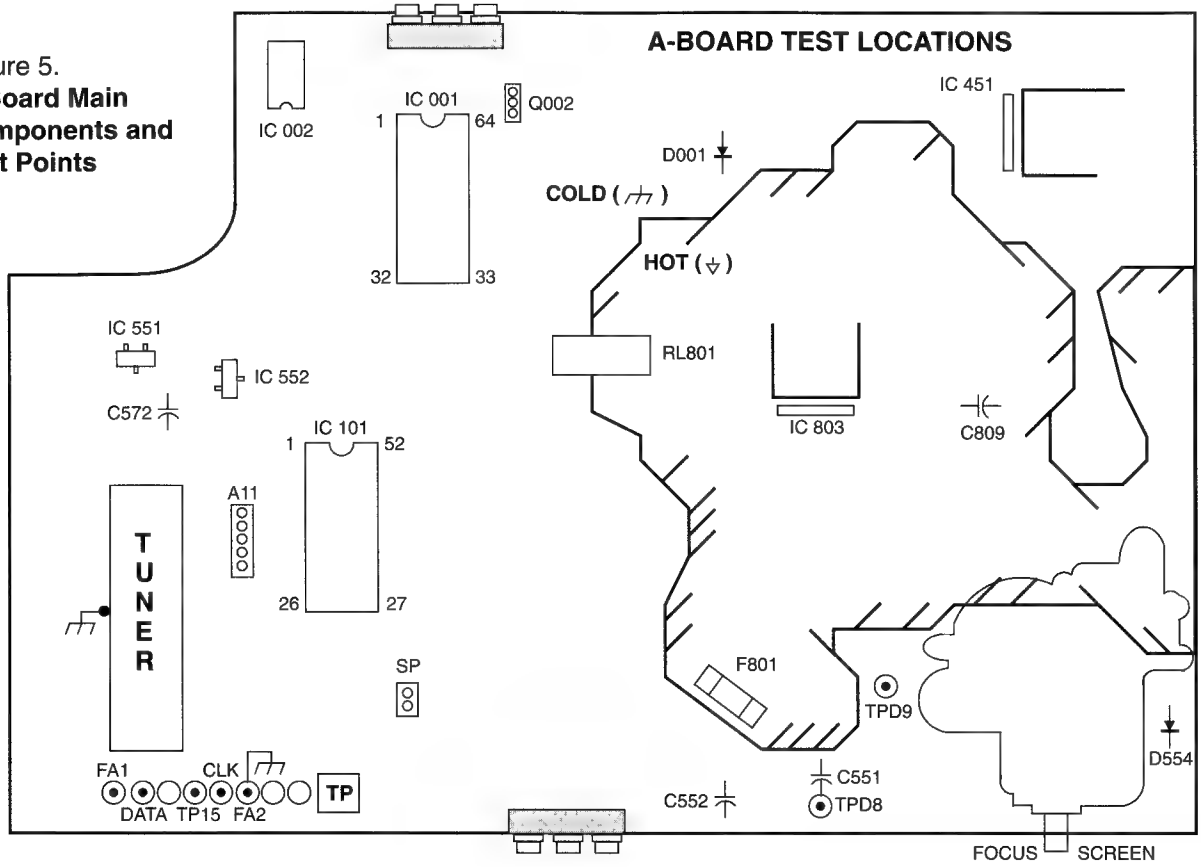
   b. Release the braid loop from the upper corners of the CRT ears.
7. Mount the dag ground braid on the replacement CRT. Position the degaussing coil with new ties. Dress coil as was on the original CRT.
8. Replace the components on CRT neck and re-install into cabinet. Verify that all ground wires and circuit board plugs get connected.

Chassis Service Adjustment Procedures

All service adjustments are factory preset and should not require adjustment unless controls and/or associated components are replaced.

Note: *Connect the (-) lead of the voltmeter to the appropriate ground. Use IC803's heat sink when the HOT ground symbol (⏚) is used. Otherwise, use COLD ground (⏚) — Tuner shield, IC451's heat sink or FA2.*

Figure 5.
A-Board Main Components and Test Points



MOMENTARILY CONNECT A JUMPER FOR ENTERING SERVICE MODE (FA1 to FA2)

131.0V B+ Voltage Confirmation

1. Set the **Bright** and the **Picture** to Minimum by using the Picture Menu.
2. Connect the DVM between C809(+ side) and cold ground (⏚).
3. Confirm that B+ voltage is **131.0V ± 2.5V**. This voltage supplies B+ to the Horizontal Output & Flyback circuits.

Source Voltage Chart

120V AC line input. Set the **Bright** and the **Picture** to Minimum by using the Picture Menu. Use cold ground (⏚) for the (-) lead of the DVM.

LOCATION		VOLTAGE
TPD8	**13" Models**	23.0V ± 2V
TPD8	**27" Models**	27.4V ± 2V
TPD9	**All Models**	13.0V ± 2V
C552 (+) side	**All Models**	20.0V ± 2V
IC551 Pin3	**All Models**	9.0V ± 0.5V
D554 Cathode	**13" Models**	180V ± 15V
D554 Cathode	**27" Models**	220V ± 15V
C572 (+) side	**All Models**	5.0V ± 0.25V

Adjust Picture Menu for normalized video adjustments.

High Voltage Check

1. Select an active TV channel and confirm that horizontal is in sync.
2. Adjust Brightness and Picture using Picture Icon menu so video just disappears.
3. Confirm B+ 131V is within limit.
4. Using a high voltage meter confirm that the High Voltage is **23.75kV ± 1.25kV** for 13" models and **29.25kV ± 1.25kV** for 27" models.

Purity and Convergence Procedure

Adjustment is necessary only if the CRT or the deflection yoke is replaced or if the setting was disturbed. The complete procedure consists of:

1. Vertical Raster Shift Adjustment. **(Only for Models with Purity/Convergence Assembly with 4 Pairs of Rings)**.
2. Initial static convergence.
3. Setting the purity.
4. Final static convergence.

When the CRT or the Yoke is Replaced

Place the yoke on the CRT neck (do not tighten the clamp).

For a 2-piece assembly (see Fig. 6):

Position purity/convergence assembly as shown and tighten clamp snugly. Remove the hot-melt glue seal on assembly and position like tabs of purity device together at 12 o'clock to reduce its magnetic field effect.

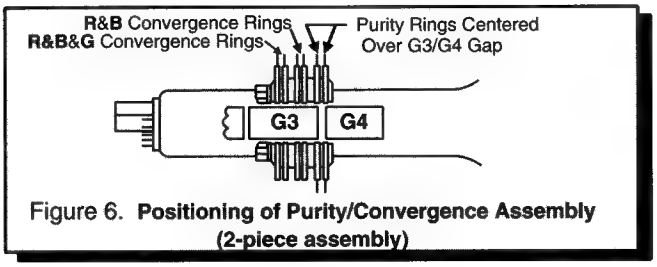


Figure 6. **Positioning of Purity/Convergence Assembly (2-piece assembly)**

For models using 4 pairs of rings, place the vertical raster shift tabs at 3 o'clock (90° from the purity and convergence tabs, see Fig. 7 and Fig. 8)

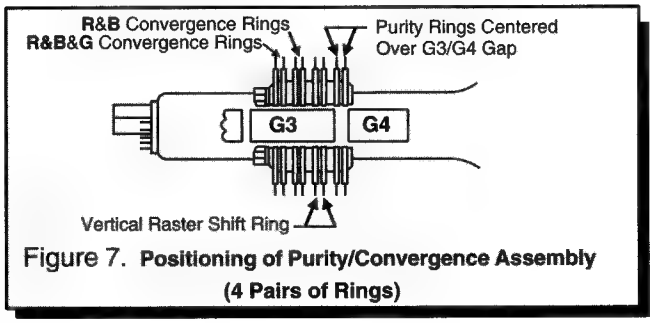


Figure 7. **Positioning of Purity/Convergence Assembly (4 Pairs of Rings)**

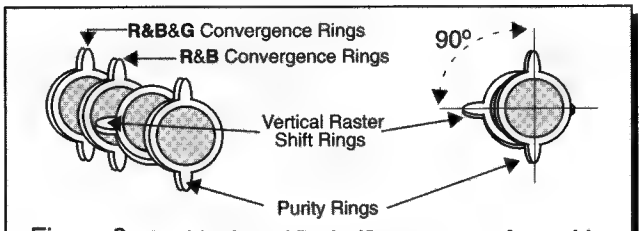


Figure 8. **Positioning of Purity/Convergence Assembly (4 Pairs of Rings)**

For a 1-piece assembly (see Fig. 9):

Position like tabs of purity devices together at 12 o'clock to reduce any magnetic field effect. (For better results, note part number and look for specifications at Service Center)

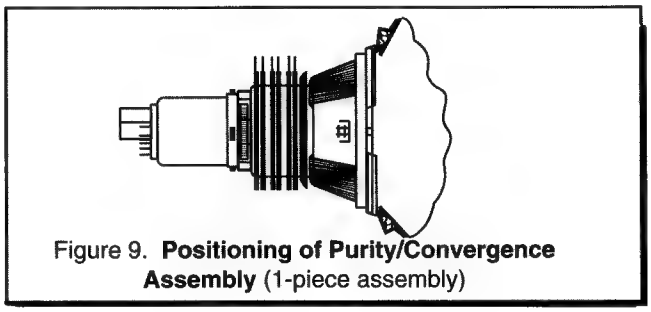


Figure 9. **Positioning of Purity/Convergence Assembly** (1-piece assembly)

For either assemblies:

Turn the Receiver ON. Operate the Receiver for 60 minutes using the first Purity Check field (white screen) to stabilize the CRT.

Fully degauss the Receiver by using an external degaussing coil.

Slide the deflection yoke back and forth on the neck of the CRT until it produces a near white, uniform raster.

Vertical Raster Shift Adjustment (Only for Models with Purity/Convergence Assembly with 4 Pairs of Rings).

Apply a green pattern with a horizontal line, adjust the Deflection Yoke so that has no tilt, then secure it.

Adjust center line of the pattern with the mechanical center of the CRT, this center is determined by two marks at the side edges of the screen. To adjust the line, once the vertical raster shift tabs are place at 3 o'clock to reduce its magnetic field effect (see Fig. 7 and Fig. 8) open the tabs the same angle from the center, until the center line of the pattern becomes a straight line, centered with the marks of the CRT. (see Fig. 10)

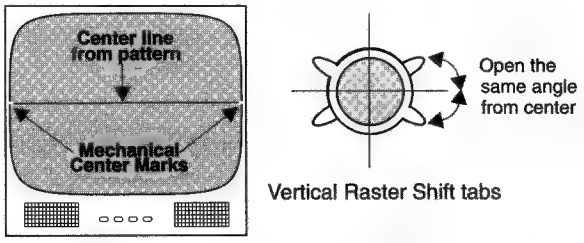


Figure 10. **Vertical Raster Shift Adjustment (4 pairs of rings assembly)**

Initial Center Static Convergence

Connect a dot/cross hatch generator to the Receiver and tune in a signal. Observe misconvergence at center of the screen only.
Adjust the R&B pole magnets; by separating tabs and rotating to converge blue with red.
Adjust the R&B and R&B&G pole magnets: by separating tabs and rotating to converge blue and red (magenta) with green.

Note: *Precise convergence at this point is not important.*

Purity Adjustment

When the Receiver is in the Serviceman Mode for making electronic adjustments, press the **Recall** button on the Remote Control to enter Purity Check. (See the **Service Adjustments Electronic Controls** procedure).
Operate the Receiver for 60 minutes using the first Purity Check field (white screen) to stabilize the CRT.
Fully degauss the Receiver by using an external degaussing coil.
Press the **Recall** button on the Remote Control again until the Purity Check (green screen) appears.

For a 2-piece assembly (see Fig. 6)**:**
Loosen the deflection yoke clamp screw and move the deflection yoke back as close to the purity magnet as possible.
Adjust the Purity rings to set the vertical green raster precisely at the center of the screen (see Fig. 11).

NOTES:
1. CRT warm up with white screen (three guns activated) is needed to stabilize the shadow mask expansion.
2. Initial center static convergence (roughly centers three gun beams) is required in order to perform purity adjustment.

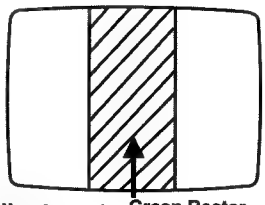


Figure 11. **Green Raster Adjustment**

Slowly move the deflection yoke forward until the best overall green screen is displayed.

For a 1-piece assembly (see Fig. 9)**:**
Slowly move the deflection yoke and purity rings assembly toward the CRT board and adjust the purity magnet rings to set vertical green raster at center of screen (see Fig. 11).
Gradually move the deflection yoke & purity rings forward and adjust for best overall green screen.

Continue from here for either assemblies:
Tighten the deflection yoke clamp screw.
Press the **Recall** button on the Remote Control again until the purity check (blue screen) and (red screen) appear and observe that good purity is obtained on each respective field.
Press the **Recall** button on the Remote Control again until Purity check (white screen) appears. Observe the screen for uniform white. If purity has not been achieved, repeat the above procedure.

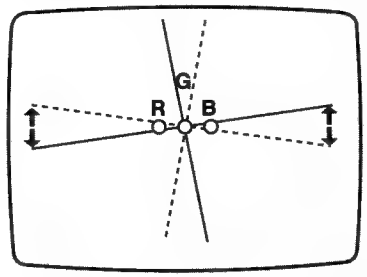
Final Convergence Procedure (see Fig. 12 through Fig. 14):

Note: *Vertical size and focus adjustments must be completed prior to performing the convergence adjustment. Connect a dot pattern generator to the Receiver. The* ***Brightness*** *level should not be higher than necessary to obtain a clear pattern.*
Converge the red and the blue dots at the center of the screen by rotating the R&B pole Static Convergence Magnets.
Align The converged red/blue dots with the green dots at the center of the screen by rotating the R&B&G pole Static Convergence Magnets. Melt wax with soldering iron to reseal the magnets.
Slightly tilt vertically and horizontally (do not rotate) the deflection yoke to obtain a good overall convergence.
If convergence is not reached at the edges, insert permalloy (see following section) from the DY corners to achieve proper convergence. Recheck for purity and readjust if necessary.
After vertical adjustment of the yoke, insert wedge at 11 o'clock position, then make the horizontal tilt adjustment.
Secure the deflection yoke by inserting two side wedges at 3 and 7 o'clock positions.
Apply adhesive between tab (thin portion) of wedge and CRT and place tape over the tab to secure to the CRT.

Permalloy Convergence Corrector Strip (Part No. 0FMK014ZZ)

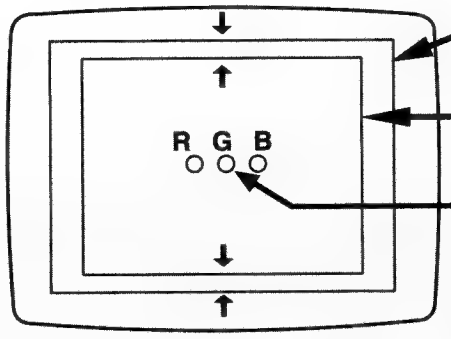
This strip is used in some sets to match the yoke and CRT for optimum convergence. If the yoke or CRT is replaced, the strip may not be required.
First converge the set without the strip and observe the corners.

If correction is needed:
1. Place strip between CRT and yoke, in quadrant needing correction. Slowly move it around for desired results.
2. Press adhesive tightly to the CRT and secure with tape.



As the yoke is tilted vertically, the rasters produced by the outside guns rotate in opposite directions.

Figure 12. **Vertical Yoke Movement**



Raster produced from one of the outside electron beams

Raster from the other side electron beam

Static convergence magnets are set for center convergence

As the yoke is tilted horizontally, one raster gets larger while the other gets smaller

Figure 13. **Horizontal Yoke Movement**

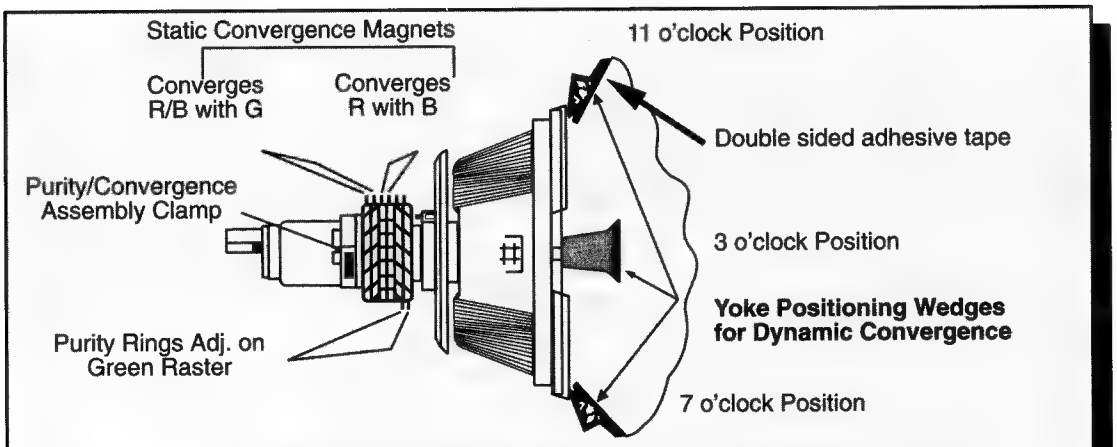


Figure 14. **Convergence Magnets and Wedges Location**

Note: *For models using 4 pairs of rings assemblies see Fig. 7 for details*

Serviceman Mode (Electronic Controls)

This Receiver has electronic technology using the I²C Bus Concept. It performs as a control function and it replaces many mechanical controls. Instead of adjusting mechanical controls individually, many of the control functions are now performed by using "On Screen Display Menu". (The **Serviceman Adjustment Mode**.)

Note: *It is suggested that the technician reads all the way through and understand the following procedure for Entering/Exiting the **Serviceman Adjustment Mode**; then proceed with the instructions working with the Receiver. When becoming familiar with the procedure, the Flow Chart for Serviceman Mode may be used as a quick guide.*

Quick Entry to Serviceman Mode:

At times when minor adjustments need to be done to the electronic controls, the method of Entering the serviceman Mode without removal of the cabinet back is as follows using the Remote Control:

1. Select SET-UP icon and select CABLE mode.
2. Select TIMER icon and set SLEEP time for 30 Min.
3. Press ACTION button twice to exit menus.
4. Tune to the Channel 124.
5. Adjust VOLUME to minimum (0).
6. Press the VOL ◀ button (decrease) **on Receiver**. Red "CHK" appears in upper corner.

To toggle between Aging and Serviceman modes:

While the "CHK" is displayed on the left top corner of the CRT, pressing the Action and the Volume Up buttons on the Receiver simultaneously will toggle between the modes. Red "CHK" for Serviceman and yellow "CHK" for Aging.

7. **Press** the **Power** Button on the **Remote Control** to select one of six Serviceman Adjustment Modes.
   1) **B**= Serviceman VCJ SUB-DATA ADJUSTEMENT.
   2) **C**= Serviceman VCJ CUT-OFF ADJUSTMENT.
   3) **S**= Serviceman OPTIONS (PIP and CLOCK) ADJUSTMENT.
   4) **M**= Serviceman MTS ADJUSTMENTS.
   5) **X** = Serviceman COMB FILTER ADJUSTMENT.
   6) "**CHK**" = Normal operation of CHANNEL ▲▼ and VOLUME ◀ ▶.

Note: *Only the applicable settings for the Receiver serviced will be available (See* **a** *in Fig. 15).*

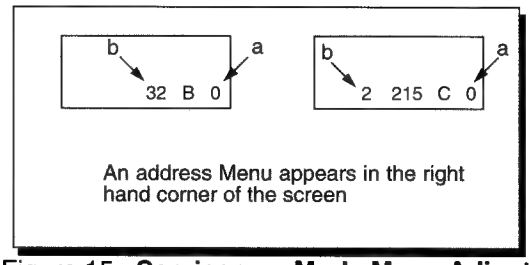


Figure 15. **Serviceman Mode Menu Adjustments.**

Exiting the Serviceman Mode:

Press the **Action** and the **Power** buttons on the **Receiver** simultaneously for at least 2 seconds.

THE RECEIVER EXITS SERVICEMAN MODE.

The Receiver momentarily shuts off; then comes back on tuned to channel 3 with a preset level of sound. Any programmed channels, channels caption data and some others user defined settings will be erased.

IMPORTANT NOTE:
Always Exit the Serviceman Mode Following Adjustments.

Press the **Power Button** on the **Remote Control** to select the Serviceman Adjustment .

For Adjustments:

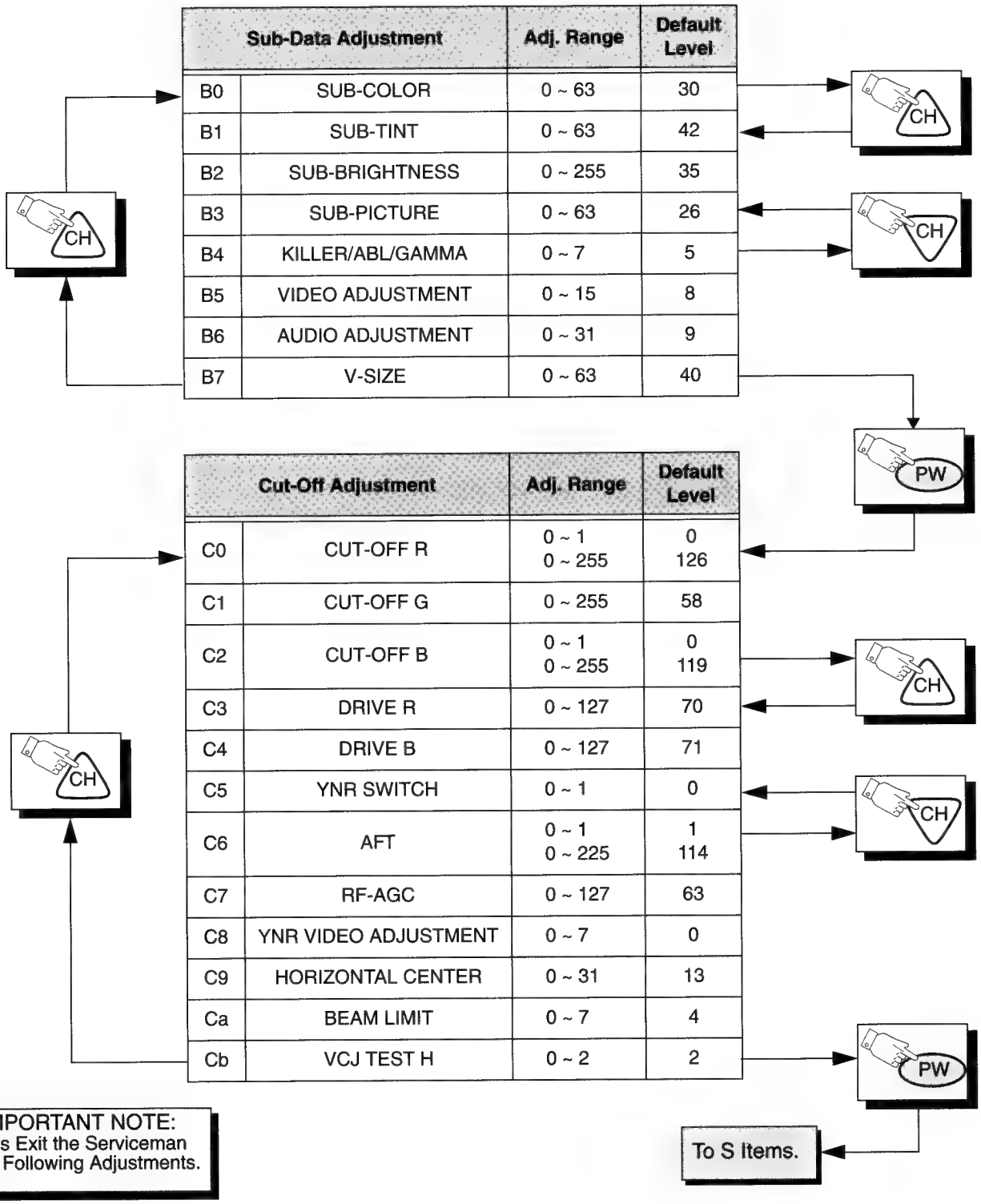
1. **Press Channel Up/Down** on the **Remote Control** to select one of the available Service Adjustments (**a** in Fig. 15).

Note: *Write Down the original value set (**b** in* Fig. 15*) for each address before modifying anything. It is easy to erroneously adjust the wrong item.*

2. **Press Volume Up/Down** on the **Remote Control** to adjust the level of the selected Service Adjustment (**b** in Fig. 15).

Sub-Data Adjustment		Adj. Range	Default Level
B0	SUB-COLOR	0 ~ 63	30
B1	SUB-TINT	0 ~ 63	42
B2	SUB-BRIGHTNESS	0 ~ 255	35
B3	SUB-PICTURE	0 ~ 63	26
B4	KILLER/ABL/GAMMA	0 ~ 7	5
B5	VIDEO ADJUSTMENT	0 ~ 15	8
B6	AUDIO ADJUSTMENT	0 ~ 31	9
B7	V-SIZE	0 ~ 63	40

Cut-Off Adjustment		Adj. Range	Default Level
C0	CUT-OFF R	0 ~ 1 0 ~ 255	0 126
C1	CUT-OFF G	0 ~ 255	58
C2	CUT-OFF B	0 ~ 1 0 ~ 255	0 119
C3	DRIVE R	0 ~ 127	70
C4	DRIVE B	0 ~ 127	71
C5	YNR SWITCH	0 ~ 1	0
C6	AFT	0 ~ 1 0 ~ 225	1 114
C7	RF-AGC	0 ~ 127	63
C8	YNR VIDEO ADJUSTMENT	0 ~ 7	0
C9	HORIZONTAL CENTER	0 ~ 31	13
Ca	BEAM LIMIT	0 ~ 7	4
Cb	VCJ TEST H	0 ~ 2	2



Press the Power Button on the Remote Control to select the Serviceman Adjustment

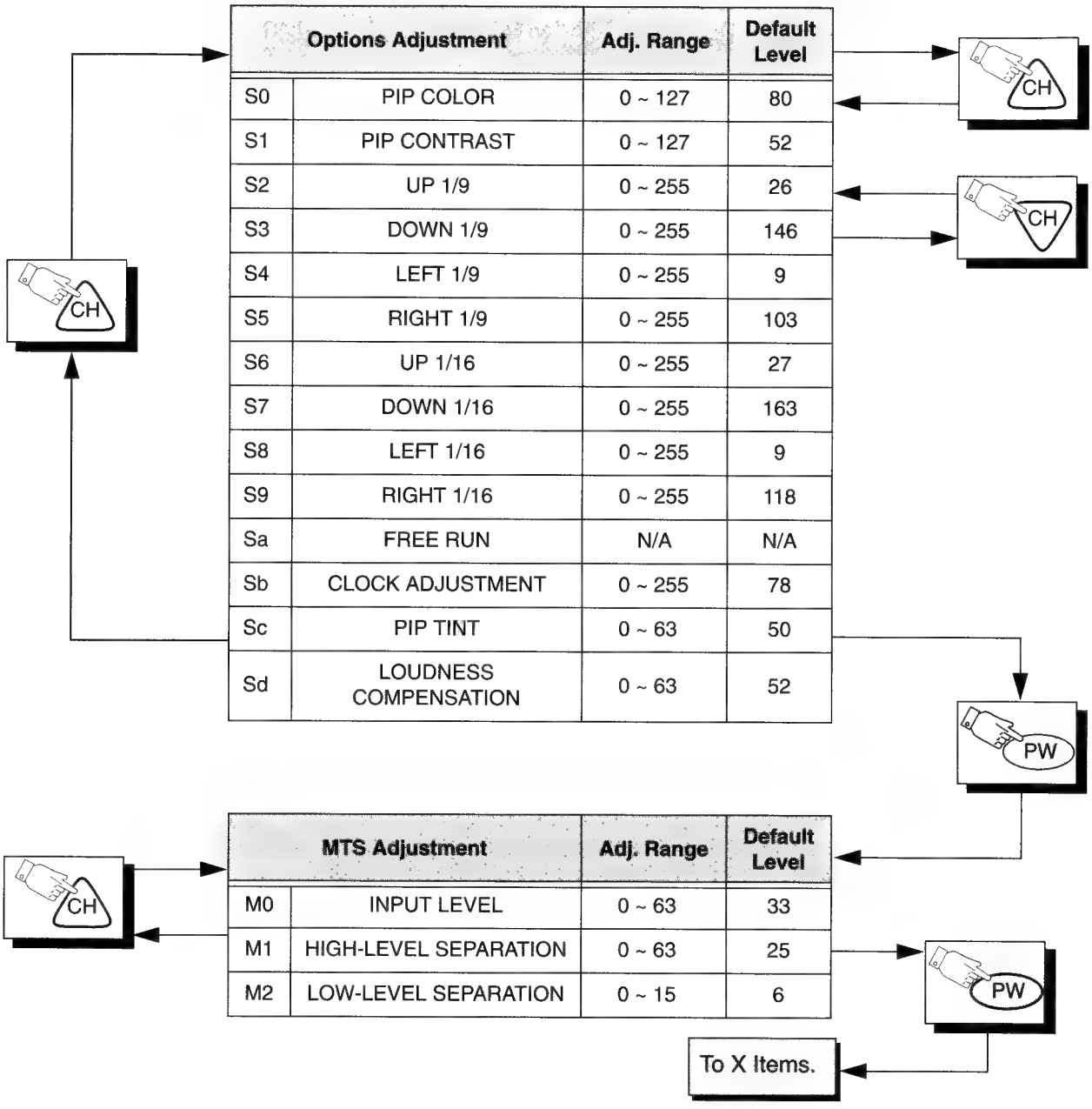
For Adjustments:

1. **Press Channel Up/Down** on the **Remote Control** to select one of the available Service Adjustments (**a** in Fig. 15).

Note: *Write Down the original value set (**b** in* Fig. 15*) for each address before modifying anything. It is easy to erroneously adjust the wrong item.*

2. **Press Volume Up/Down** on the **Remote Control** to adjust the level of the selected Service Adjustment (**b** in Fig. 15).

Options Adjustment		Adj. Range	Default Level
S0	PIP COLOR	0 ~ 127	80
S1	PIP CONTRAST	0 ~ 127	52
S2	UP 1/9	0 ~ 255	26
S3	DOWN 1/9	0 ~ 255	146
S4	LEFT 1/9	0 ~ 255	9
S5	RIGHT 1/9	0 ~ 255	103
S6	UP 1/16	0 ~ 255	27
S7	DOWN 1/16	0 ~ 255	163
S8	LEFT 1/16	0 ~ 255	9
S9	RIGHT 1/16	0 ~ 255	118
Sa	FREE RUN	N/A	N/A
Sb	CLOCK ADJUSTMENT	0 ~ 255	78
Sc	PIP TINT	0 ~ 63	50
Sd	LOUDNESS COMPENSATION	0 ~ 63	52



MTS Adjustment		Adj. Range	Default Level
M0	INPUT LEVEL	0 ~ 63	33
M1	HIGH-LEVEL SEPARATION	0 ~ 63	25
M2	LOW-LEVEL SEPARATION	0 ~ 15	6

IMPORTANT NOTE:
Always Exit the Serviceman Mode Following Adjustments.

Press the Power Button on the Remote Control to select the Serviceman Adjustment

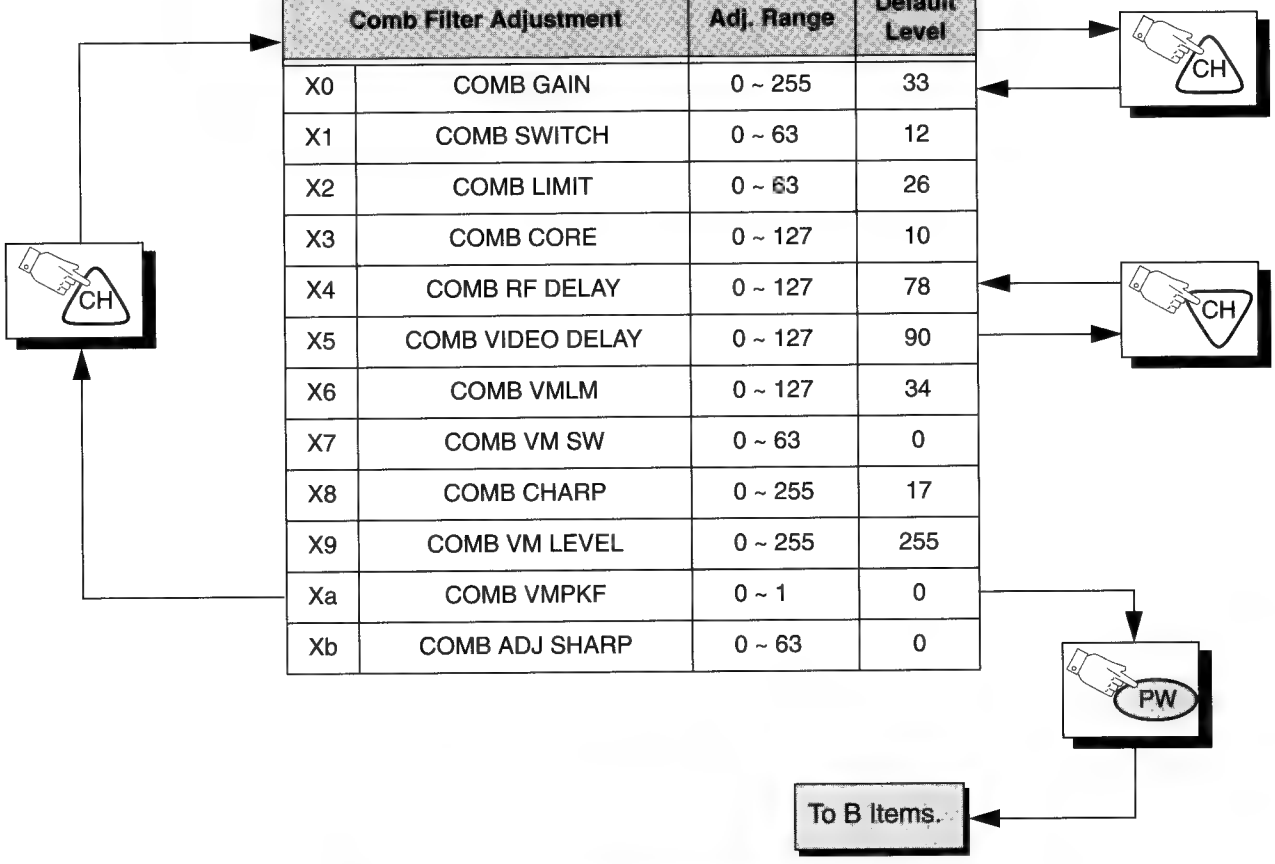
For Adjustments:

1. **Press Channel Up/Down** on the **Remote Control** to select one of the available Service Adjustments (**a** in Fig. 15).

Note: *Write Down the original value set (**b** in* Fig. 15*) for each address before modifying anything. It is easy to erroneously adjust the wrong item.*

2. **Press Volume Up/Down** on the **Remote Control** to adjust the level of the selected Service Adjustment (**b** in Fig. 15).

Comb Filter Adjustment		Adj. Range	Default Level
X0	COMB GAIN	0 ~ 255	33
X1	COMB SWITCH	0 ~ 63	12
X2	COMB LIMIT	0 ~ 63	26
X3	COMB CORE	0 ~ 127	10
X4	COMB RF DELAY	0 ~ 127	78
X5	COMB VIDEO DELAY	0 ~ 127	90
X6	COMB VMLM	0 ~ 127	34
X7	COMB VM SW	0 ~ 63	0
X8	COMB CHARP	0 ~ 255	17
X9	COMB VM LEVEL	0 ~ 255	255
Xa	COMB VMPKF	0 ~ 1	0
Xb	COMB ADJ SHARP	0 ~ 63	0



Note: *Some adjustments modes may not be available in some models depending on available options.*

IMPORTANT NOTE:
Always Exit the Serviceman Mode Following Adjustments.

To Check Purity:

Press the **Recall** Button on the **Remote Control** when in Serviceman Mode (red "CHK" is displayed) to enter the Purity Field Check Mode.

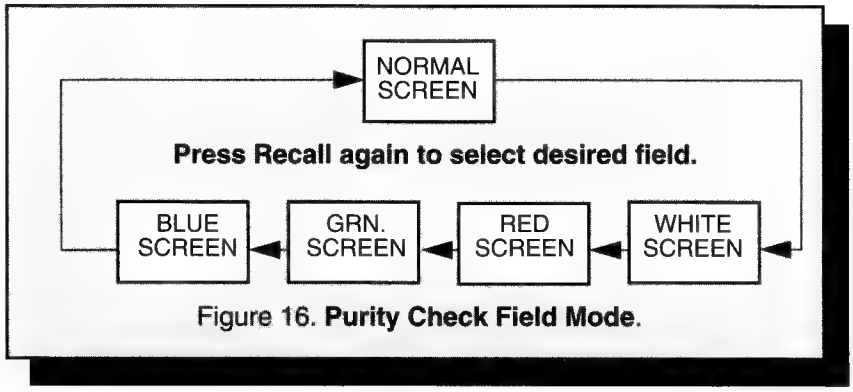


Figure 16. **Purity Check Field Mode.**

Helpful Hints

Entering Serviceman Mode (Back-Open Method)

1. While the Receiver is ON and operating in Normal Mode, momentarily short test point **FA1** (TP8) to Cold Ground (⏚) **FA2** (TP3) A-Board.
   The Receiver enters the Aging Mode.
   Yellow letters "CHK" appear in the upper left corner of the CRT.
   (The Volume Up/Down will adjust rapidly).
2. Simultaneously press the **Action** and the **Volume Up** buttons on the **Receiver** Control Panel.
   The Receiver enters the Serviceman Mode.
   The letter in "CHK" turn red.
   (The Volume Up/Down will adjust normally).
   (All costumer controls are set to nominal level).

IMPORTANT NOTE:
Always Exit the Serviceman Mode Following Adjustments.

Instructional Flow Chart for Serviceman Mode

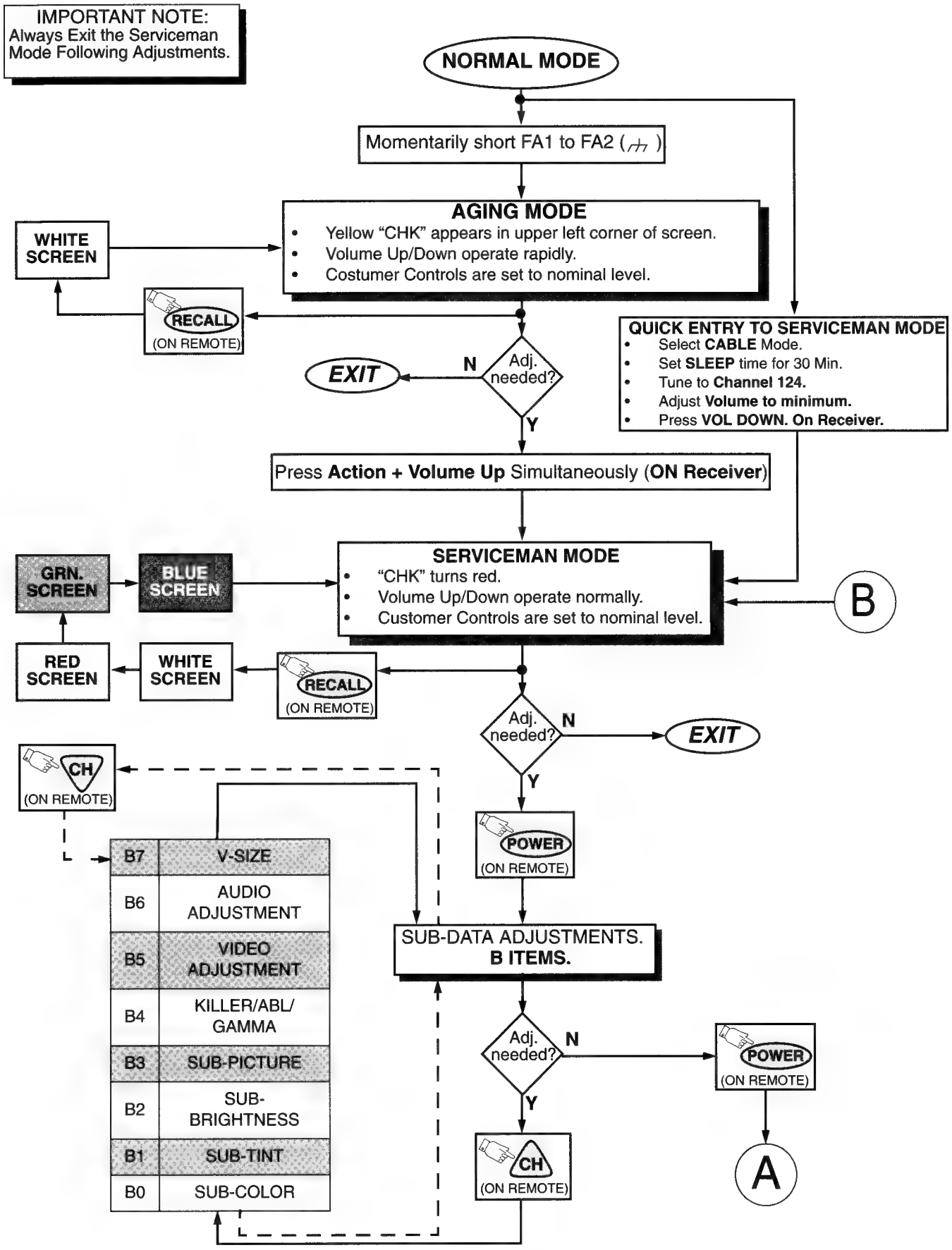


Figure 17.**Flow Chart for Serviceman Mode**.

Instructional Flow Chart for Serviceman Mode - Continued

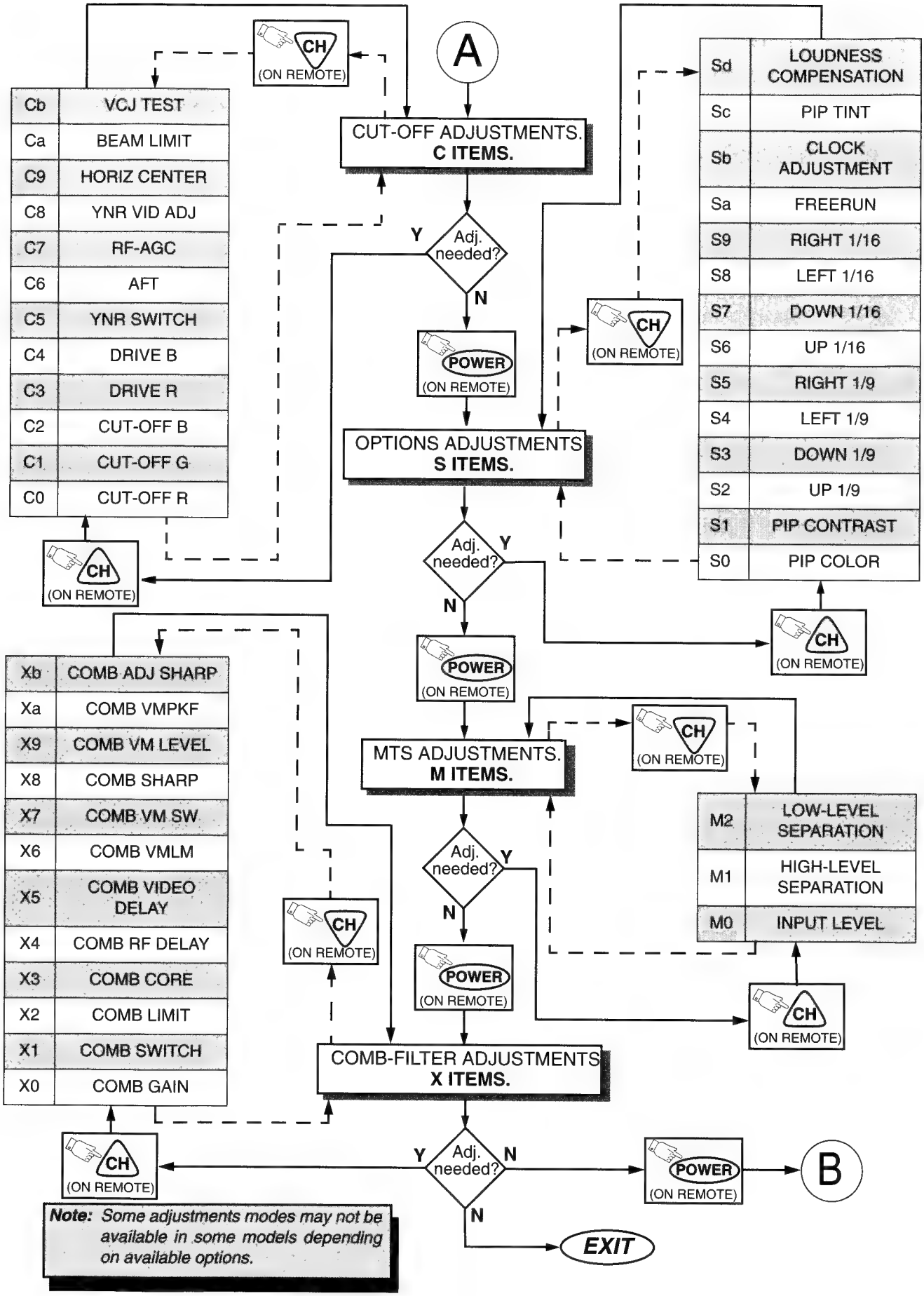


Figure 18. **Flow Chart for Serviceman Mode.**(Continued)

Service Adjustments (Electronic Controls)

Sub-Brightness

Serviceman DAC Adjustment (B2)

Adjustment of this control is important for setting proper operation of customer brightness and picture controls. This adjustment must be made after Sub-Contrast or Color Temperature adjustments are made. **Do not adjust** SCREEN after the Sub-Brightness is set.

Preparation:

Apply a color bar signal wit 100 IRE white and 7.5 IRE black. (Switch Color to "OFF" on the signal generator.) Operate the Receiver for a minimum of 10 minutes prior to performing this adjustment.

Procedure:

In the Serviceman Mode for making electronic adjustments, select the DAC adjustment (B2) and adjust until the black starts to look gray. Then decrease the level to the point where gray turns to black.

Note: *You may set the accurate value following the Preparation steps and the Procedure step No. 2 of the Sub-Contrast adjustment described below.*

Video Adjustment Level

Serviceman DAC Adjustment (B5)

Preparation:

1. Obtain an NTSC color bar pattern with 100 IRE white and 87.5% modulation.
2. Connect the oscilloscope to TP12. Use cold ground for scope connection. Set the scope at Horizontal Sweep rate (20µs) time base.

Procedure:

1. In the Serviceman Mode for making electronic adjustments, select DAC Video Adjustment Level (B5) and adjust for 1V from sync tip to white level. See Fig. 19.

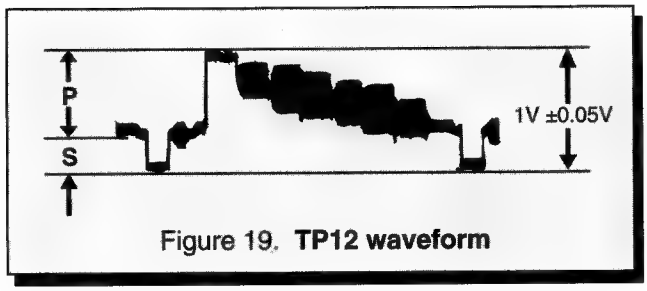


Figure 19. **TP12 waveform**

2. Check that the sync signal amplitude (ratio between the sync signal to detection output) is within the range of 30 ±5% (S/(S+P) = 30 ±5%).
3. Set the DAC Sub-Contrast Adjustment (B3).

Sub-Contrast

Serviceman DAC Adjustment (B3)

This adjustment is factory set. **Do not adjust** unless repairs are made to associated circuit, the CRT Board or when the CRT is replaced.

Preparation:

1. Apply a color bar signal pattern with 87.5% modulation, 70% saturated color bar with a 100 IRE white and 7.5 black.

Note: *The pattern used in this procedure is an EIA color bar pattern with 87.5% modulation with 100 IRE white and 7.5 black. Correlate the information in this procedure to the pattern used if another signal is used.*

2. Preset the following controls:
   - Brightness. . . . . Center.
   - Color. . . . . Min.
   - Picture . . . . . Max.
   - Sharpness . . . . . Center.
3. Connect the oscilloscope to the CRT-Board connector C1-2. Set the scope time base to 20µs (horizontal).
4. Connect a jumper from TPD2 to ground (⏚).
5. Connect a jumper from IC101 pin 28 to ground (⏚).

Procedure:

1. In the Serviceman Mode for electronic adjustments, select DAC Sub-Contrast Adjustment (B3) and adjust for **2.6Vp-p ±0.1V** for 13" models and **2.8Vp-p ±0.1V** for 27" models from white level to black level on video waveform (see video waveforms detail, Fig. 20).

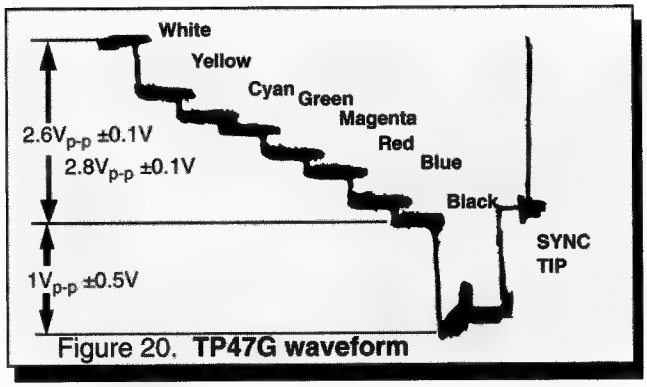


Figure 20. **TP47G waveform**

2. In the Serviceman Mode, select DAC Sub-Brightness Adjustment (B2) and adjust for 1.0-1.5Vp-p between blanking and 7.5 IRE level. (See video waveforms detail, Fig. 20).
3. Remove the jumpers (Preparation steps 4 & 5).

Tint/Color Adjustment

Serviceman DAC Adjustment (B1) (B0)

Preparation:

1. Apply a rainbow color bar signal.
2. Preset the following controls:
   - Brightness . . . . . Min.
   - Color. . . . . Center.
   - Tint . . . . . Center.
   - Picture . . . . . Max.
   - Sharpness . . . . . Min.
3. Connect the oscilloscope to TP47B (A-Board).
4. Connect a jumper from TPD2 to GND (⏚).
5. Connect a jumper from IC101 pin 28 to GND (⏚).

Service Adjustments (Electronic Controls, cont.)

Procedure:

1. In the Serviceman Mode for making electronic adjustments, select DAC Sub-Tint Adjustment (B1). Adjust until the waveform measured is as the one shown in Fig. 21.

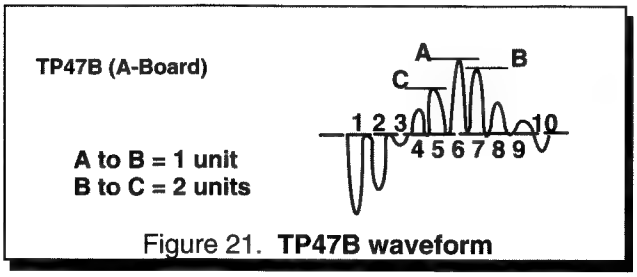


Figure 21. **TP47B waveform**

2. Connect the oscilloscope to TP47G (A-Board).
3. Select DAC Sub-Color Adjustment (B0) and adjust for peak to peak amplitude to be **0.75Vp-p ±0.05V** for 13" models and **0.85Vp-p ±0.05V** for 27" models as shown in Fig. 22.

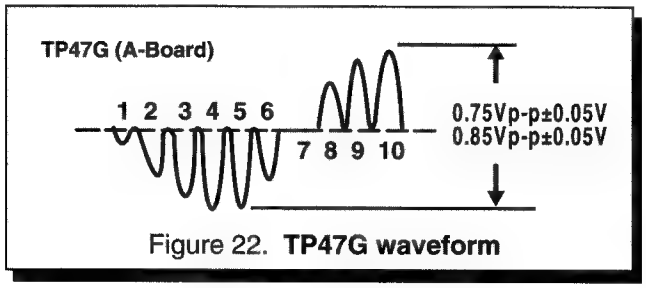


Figure 22. **TP47G waveform**

4. Remove the jumpers (Preparation steps 4 & 5).

Color Temperature Adjustment (B/W Tracking)

Serviceman DAC Adjust. (C0) (C1) (C2) (C3) (C4)
Minor Touch-Up Method

OBSERVE low and high brightness areas of a B/W picture for proper tracking. Adjust only as required for "good gray scale and warm highlights".

1. LOW LIGHT areas – In Serviceman Mode for making electronic adjustments, select Cutoff (C0) RED, (C1) GRN, (C2) BLU and adjust the picture for gray.
2. HIGH LIGHT areas – In Serviceman Mode for making electronic adjustments, select Drive (C3) RED, (C4) BLU and adjust the picture for warm whites.

Complete Adjustment

Preparation:

1. Turn the Receiver "ON" and allow 10 minutes warm up at high brightness.
2. Apply a color bar signal with color "OFF".
3. Turn the SCREEN control (part of FBT T551) fully counterclockwise.

Procedure:

Preset the following Serviceman DACs for best results:

- C0 . . . . . 0 128
- C1 64
- C2 . . . . . 0 128
- C3 64
- C4 64

1. Connect the oscilloscope to C1-2 (CRT-Board).
2. In Serviceman Mode for making electronic adjustment, select the Sub-Bright DAC (B2).
3. Press the R-Tune key on the remote.
4. Observe the oscilloscope waveform at Horizontal rate and adjust the Serviceman Mode Sub-Bright DAC (B2) level until a scanning period of **3.1V** above DC ground is measured, as indicated in Fig. 23.

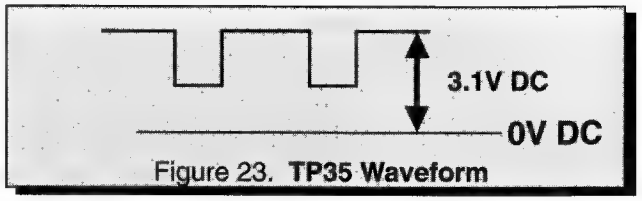


Figure 23. **TP35 Waveform**

5. Connect the scope to GRN Cathode (KG) on the CRT-Board.
6. In the Serviceman Mode for making electronic adjustments, select the GREEN CUTOFF DAC (C1).
7. Press the R-Tune key on the remote.
8. View scope trace at Horizontal rate and adjust the Serviceman Mode DAC (C1) level until a scanning period of **140V** for 13" models and **195V** for 27" models above DC ground is measured, as indicated in Fig. 24.

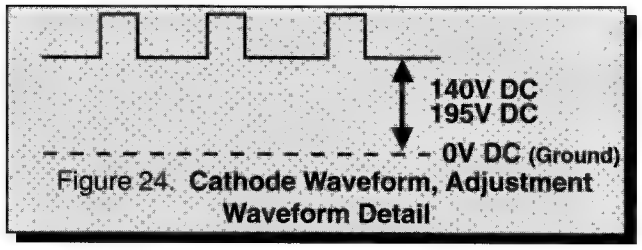


Figure 24. **Cathode Waveform, Adjustment Waveform Detail**

9. Connect the scope to the RED Cathode (KR).
10. In Serviceman Mode for making electronic adjustments, select the RED CUTOFF DAC (C0).
11. Press the R-Tune key on the Remote
12. View the scope trace and adjust the Serviceman Mode DAC (C0) for the scanning period to be **140V** for 13" models and **195V** for 27" models above DC ground. (See Fig. 24)
13. Connect the scope to the BLU Cathode (KB).
14. In Serviceman Mode for making electronic adjustments, select the BLU CUTOFF (C2).
15. Press the R-Tune key on the Remote.
16. View the scope trace and adjust the Serviceman Mode DAC (C2) for the scanning period to be **140V** for 13" models and **195V** for 27" models above DC ground. (See Fig. 24)
17. Turn the Screen Control (part of FBT) slowly clockwise until a color horizontal line appears.
18. With the other two colors Serviceman Mode DAC CUTOFF adjustments (C0) RED, (C2) BLU; increase the colors to create a white horizontal line.
19. Confirm that a good gray scale is established by viewing B/W color bar pattern.

Service Adjustments (Electronic Controls, cont.)

20. In the Serviceman Mode for making electronic adjustments select the DAC DRIVE adjustments (C3) RED, (C4) BLUE and adjust for warm white in a white color bar pattern.
21. EXIT the Serviceman Mode.
22. Adjust the Picture Menu Video Adjustments **Bright** and **Picture** from low scale to high scale and check Black and White tracking.
23. If correction is needed: Re-Enter the Serviceman Mode and perform the **Minor Touch – Up Method.**
24. Perform **Sub-Brightness** Adjustment procedure if needed.

Horizontal Centering

Serviceman DAC Adjustment (C9)

Preparation:
Connect a crosshatch generator.

Procedure:
1. In the Serviceman Mode for making electronic adjustments. Select the Horizontal Centering Adjustment DAC (C9) and adjust until the center of the crosshatch pattern is centered on CRT.
2. EXIT the Serviceman Adjustment Mode.

Audio Adjustment

Serviceman DAC Adjustment (B6)

This adjustment is factory set and needs to be performed only when IC002 or IC101 is replaced.

Preparation:
1. Apply the following signal at the antenna (70dB ±5dB, 75Ω open P/S 10dB): audio signal set to monaural, 300Hz. 100% modulation; video input of 100 IRE flat field, 30% modulation.
2. Connect the RMS Meter with filter jig as shown in Fig. 25.

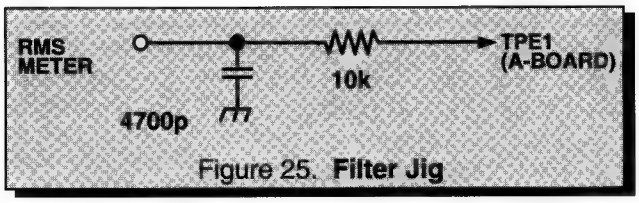


Figure 25. **Filter Jig**

Procedure:
1. In the Serviceman Mode for making electronic adjustments, select the Audio Adjustment DAC (B6) and adjust until 75mV RMS ±5.0mV RMS is measured.
2. EXIT the Serviceman Adjustment Mode.

MTS Circuit Adjustments (Stereo Models only)

The MTS Circuit Adjustments require two steps:
1. Input Level Adjustment.
2. Stereo Separation Adjustment.

Input Level Adjustment (M0) (Stereo Models only)

Preparation:
1. Connect an RMS meter with filter jig as shown in Fig. 26.

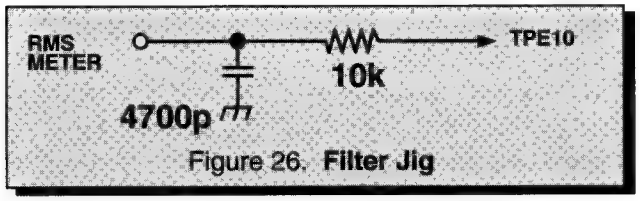


Figure 26. **Filter Jig**

2. Connect an RF signal generator to the RF antenna input.

Procedure:
1. Apply the following signal from the RF signal generator:
   Video: 100 IRE flat field, 30% modulation.
   Audio: 300Hz, 100% modulation, monaural (70 ±5dB, 75Ω OPEN, P/S 10dB).
2. Adjust the MTS Input Level Adjustment (M0) until the voltage measured is 106 ± 6.0mV rms.

Stereo Separation Adjustment (M1 & M2) (Stereo Models only)

Preparation:
1. Connect an RF signal generator to the RF antenna input.
2. Connect a scope to TPE10.

Procedure:
1. Select Stereo Mode in Audio menu
2. Apply the following signal from the RF signal generator:
   Video: 100 IRE flat field, 30% modulation.
   Audio: 300Hz, 100% modulation, stereo (left only) (70 ±5dB, 75Ω OPEN, P/S 10dB).
3. Adjust the MTS Low-Level Separation Adjustment (M2) until the amplitude displayed on the scope is minimum.
4. Apply the following signal from the RF signal generator:
   Video: 100 IRE flat field, 30% modulation.
   Audio: 3KHz, 100% modulation, stereo (left only) (70 ±5dB, 75Ω OPEN, P/S 10dB).
5. Adjust the MTS High-Level Separation Adjustment

Service Adjustments (Electronic Controls, cont.)

Clock Adjustment (Sb)

Preparation:

Connect the frequency counter from TPS1 (IC001 Pin 13) to cold ground (⏚).

Note: *Frequency Counter probe capacitance should be 8pF or less.*

Procedure:

1. Turn the Receiver "OFF" with the AC power applied.
2. Measure TPS1 (IC001 pin 13) for the frequency of the waveform and record the reading.

Note: *Pin 13 measurement must have at least four digits of resolution following the decimal point. Example: 000.0000*

3. Turn the Receiver back "ON".
4. Place the Receiver into Serviceman Mode for making electronic adjustment, select the Clock Adjustment DAC (Sb).
5. Calculate and set Sb based on the following formula:

$$Sb = 128 + 0.901 \times 10^{6\{244.1406 - pin13[Hz]\}} \over 244.1406$$

Note: *Pin 13 measurement will not change regardless of the value stored in Sb.*

Vertical Size (B7)

1. Adjust the VERTICAL SIZE DAC control, B7, until the top and the bottom edges of the raster are visible.
2. Adjust the VERTICAL SIZE control, B7, until the top and the bottom of the raster touch the bezel edge. The advance SIZE control to obtain an approximately 10% overscan. Linearity adjustment is don automatically when the size is being adjusted. (Best results can de obtained with a round test patter.)

Service Adjustments (Mechanical Controls)

VCO Field Alignment L105 (IC101 pins 35 & 36)

1. Connect a balance antenna and select a midband channel (Ch 10, 11 or 12)
2. Attenuate the signal strength for a weak noisy video.
3. While observing the picture tube, adjust L105 until best picture appears.
4. Change channels and observe that they are tuning properly.
5. If the channel monitored is not clear, repeat steps 1, 3 and 4 while applying a stronger signal.

Focus (part of T551)

Preparation:

Connect a Signal generator and select a dot pattern.

Procedure:

Adjust the FOCUS control to obtain the sharpest and clearest dot pattern.

a. Adjust for best center.
b. Adjust for best area between the center and top right corner.

DC Power Panel Adjustment (For AC/DC Model Only)

1. Attach DC Digital Voltmeter leads between (+) TPP1 and (-) P5. Using DC CAR CORD, connect recieiver to a Variable DC Power Supply and ensure that the Power Supply is set to a 12 VDC output.
2. After aging. Apply a monoscope pattern and set PICTURE and BRIGHTNESS to minimum.
3. Adjust **R855** fully counterclockwise. Slowly rotate **R855** clockwise and adjust until the Digital Voltmeter reads **131 ±1.0VDC** at TPP1. Return PICTURE and BRIGHTNESS to normal.
4. Vary the output of the 12VDC Power Supply from 10VDC to 16VDC. Confirm that B+ is less than 133VDC.
5. Confirm that current is less than 6 amps at the 12VDC Power Supply input.
6. Return controls to normal settings.

Audio Signal Path Block Diagram

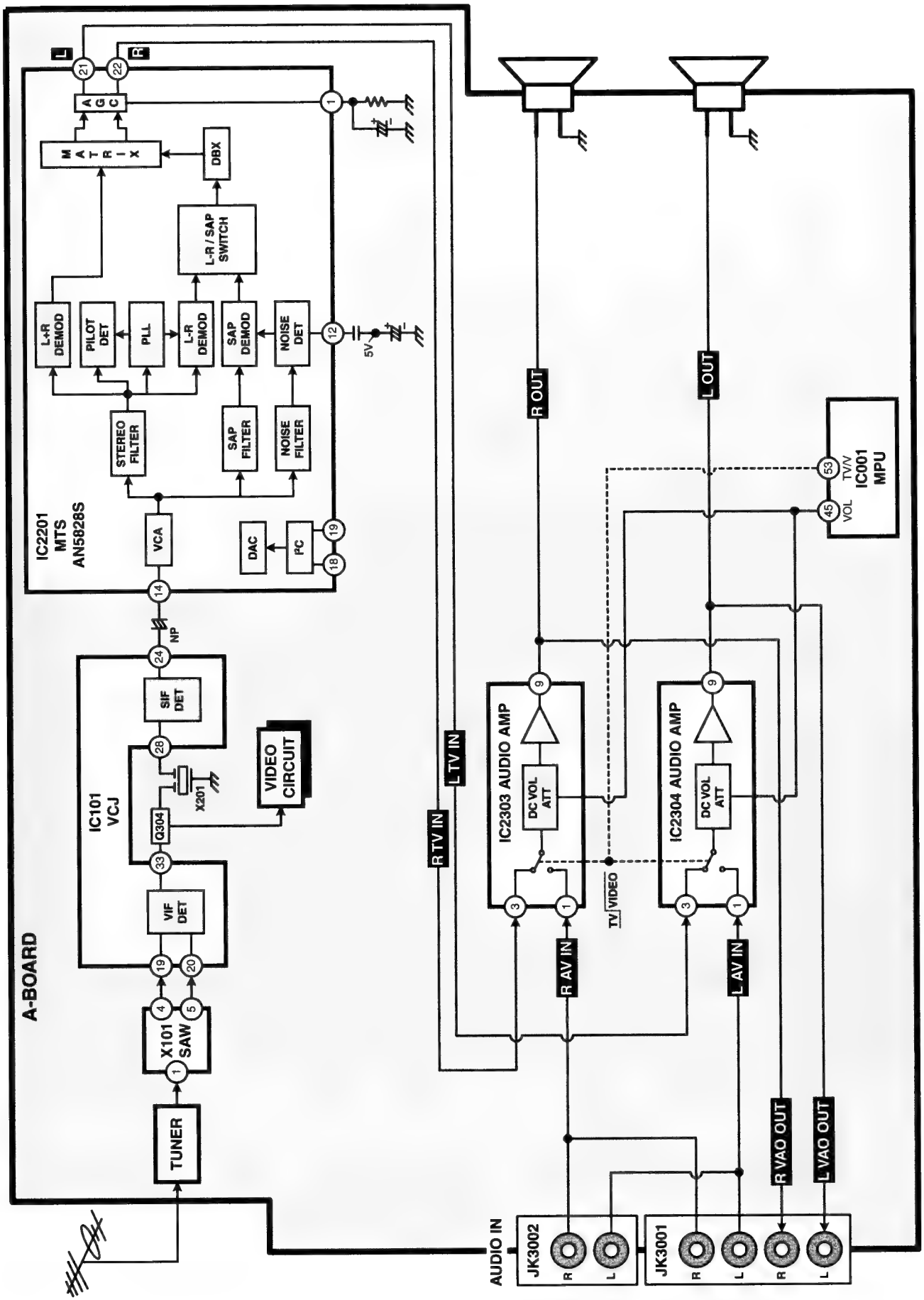


Figure 27. **Audio Signal Path Block Diagram. (Stereo Models)**

Video-Chroma Signal Path Block Diagram

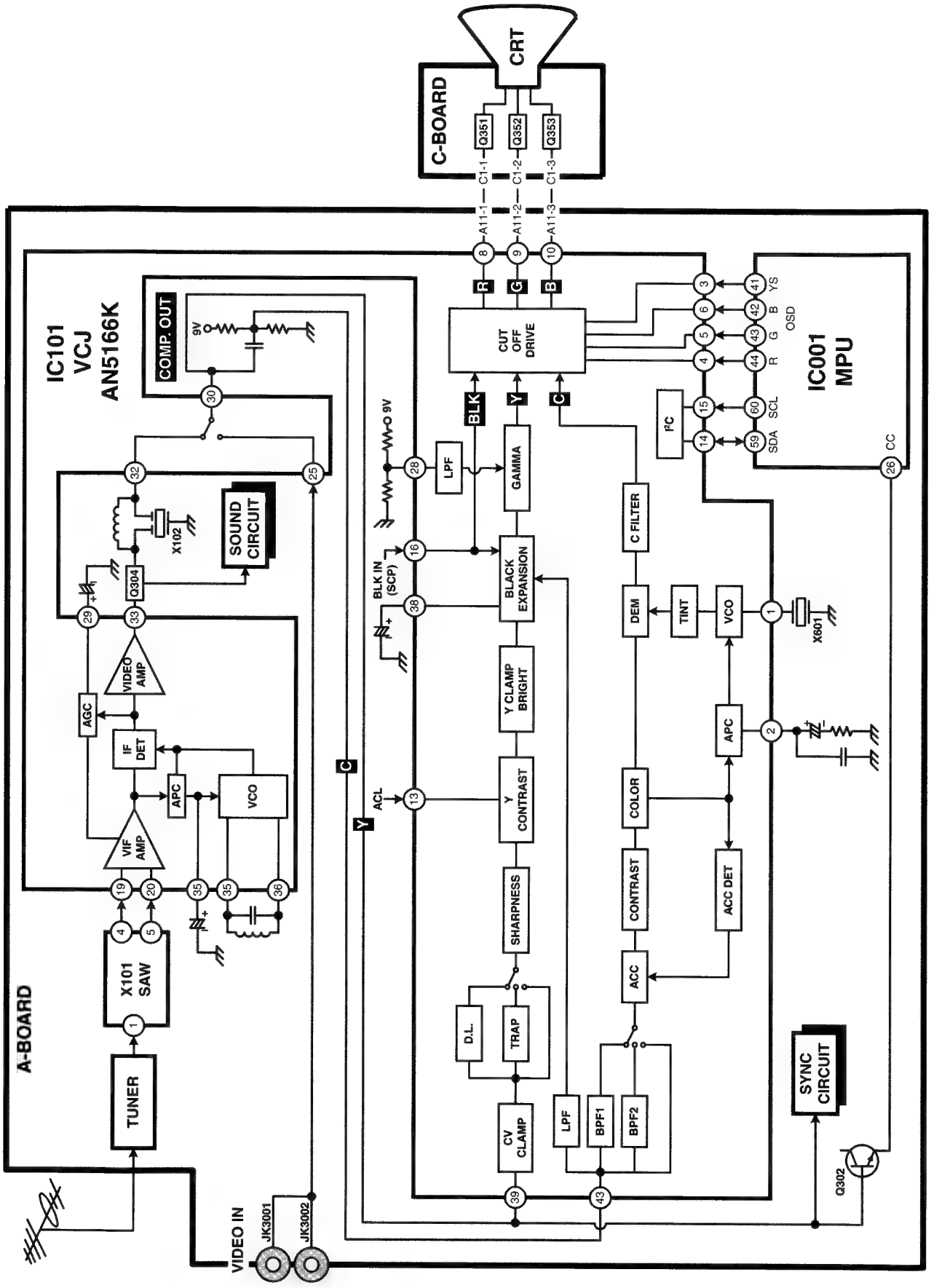


Figure 28. **Video-Chroma Signal Path Block Diagram.**

Sync Signal Path Block Diagram

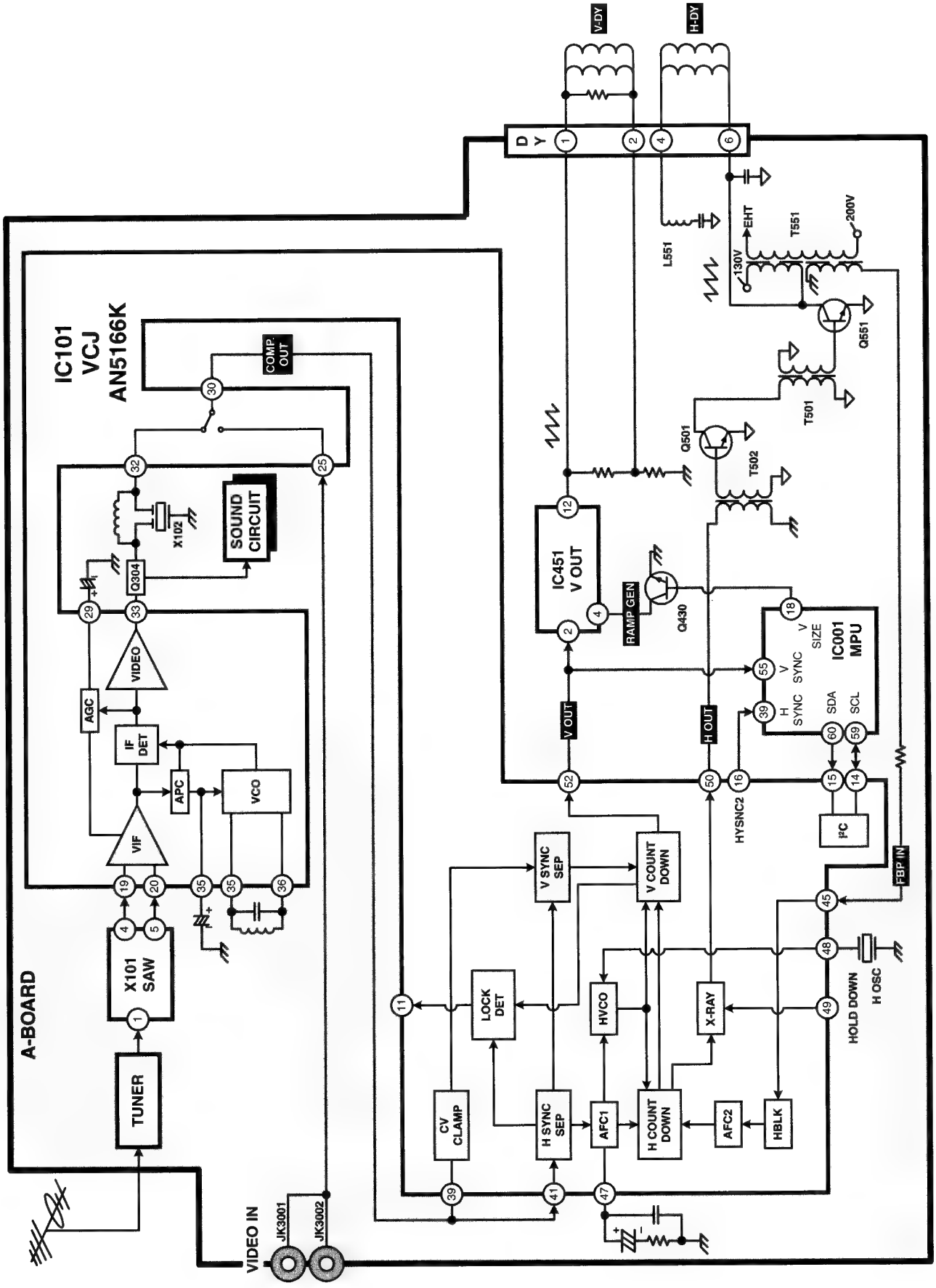


Figure 29. **Sync Signal Path Block Diagram.**

AC/DC BOARD BLOCK DIAGRAM
(CT-13R51DB)

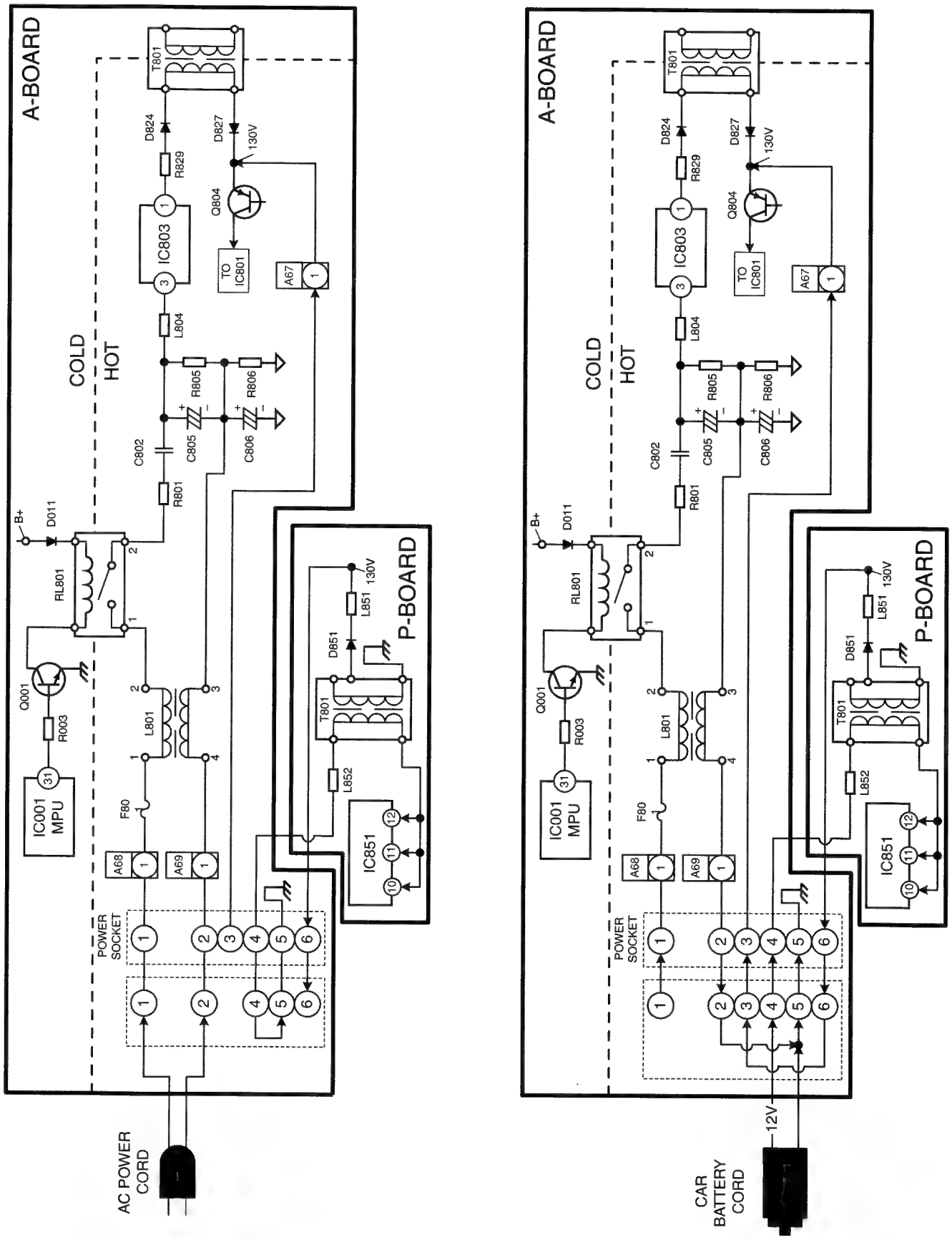


Figure 30. **AC/DC Board Block Diagram.**

IC101 IN/OUT Pins and Functions (VJC)

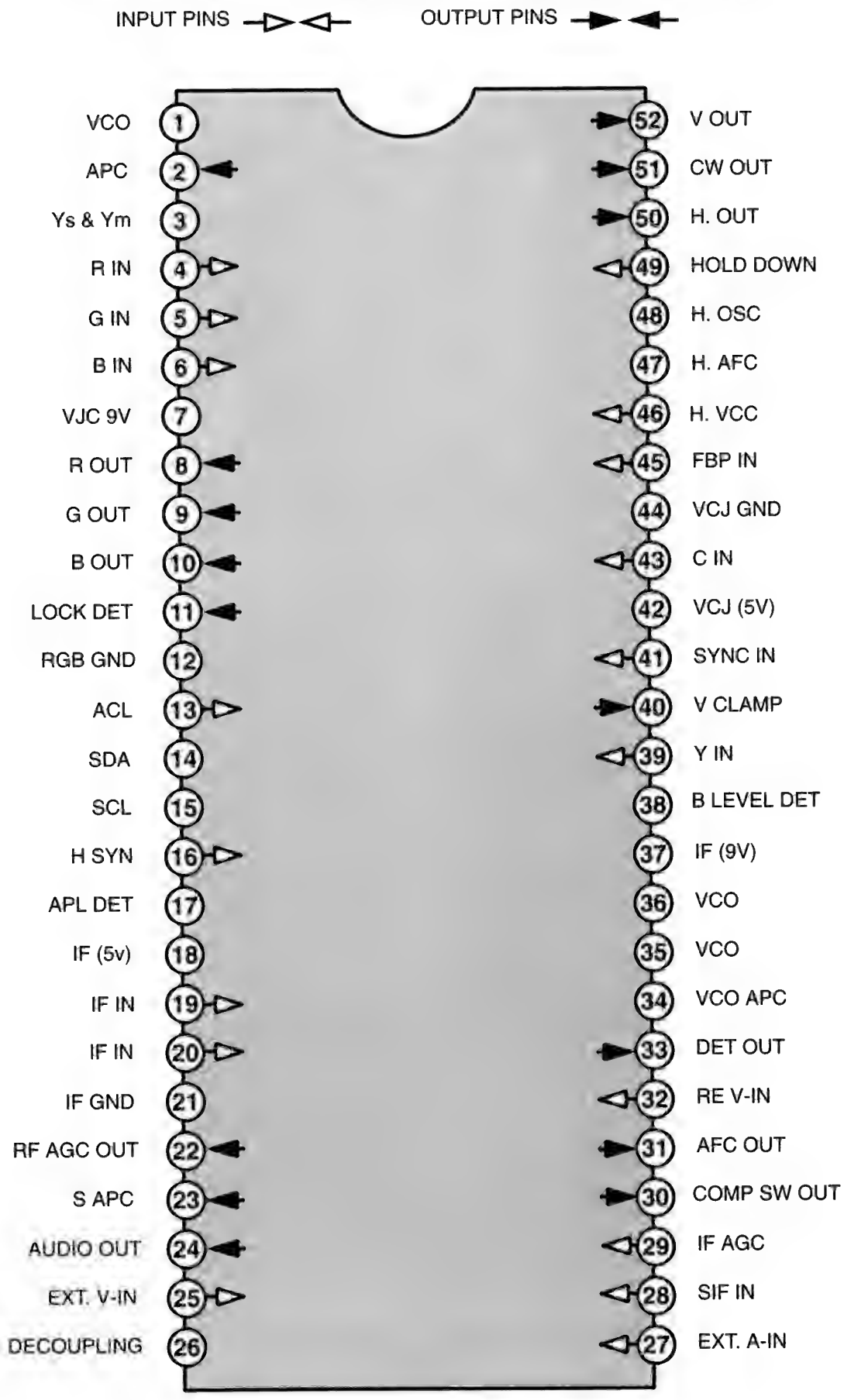


Figure 31. **IC101 (VJC) Pins and Functions.**

IC001 IN/OUT Pins and Functions (MPU)

IC001 MPU

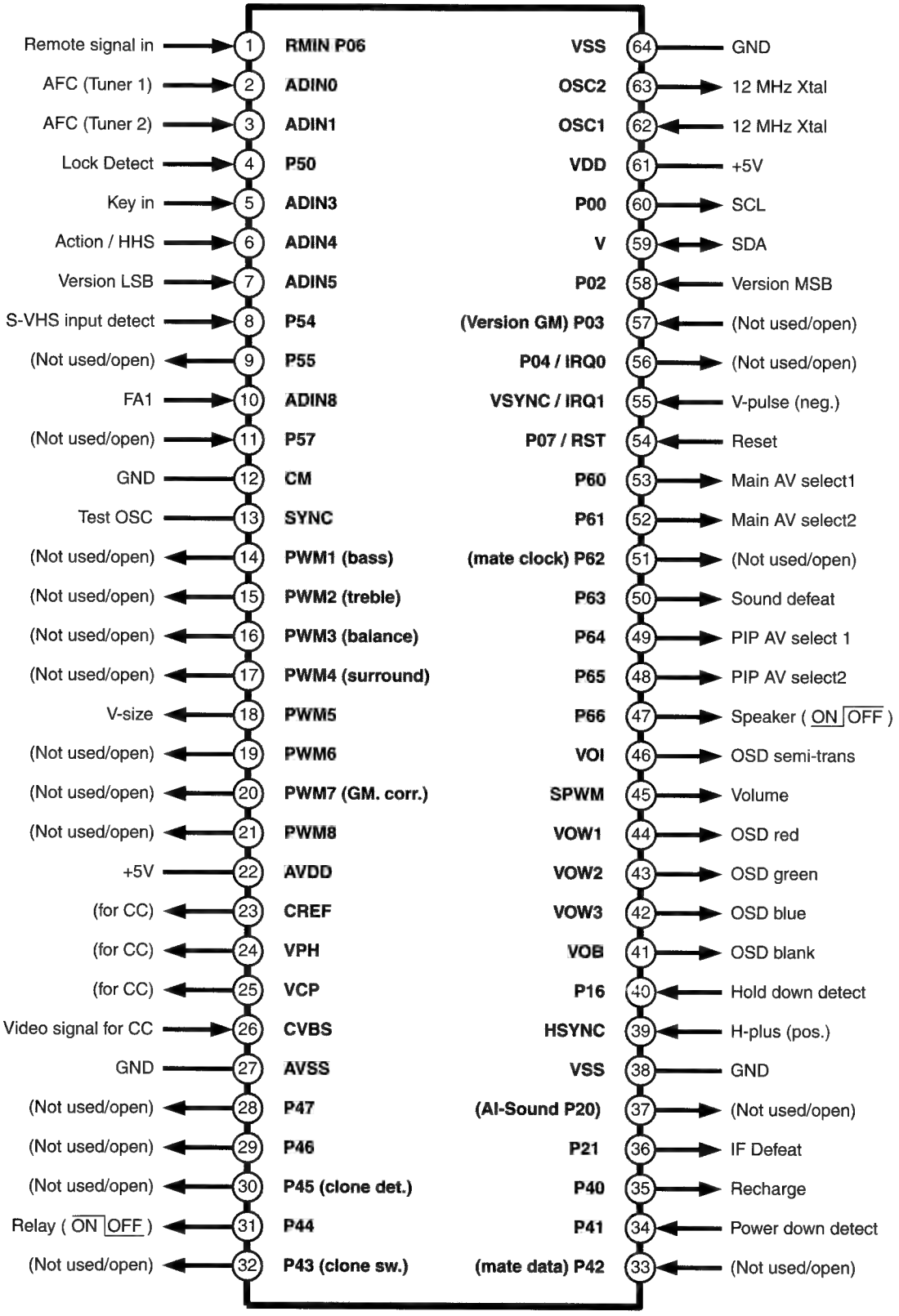


Figure 32. **IC001 (MPU) Pins and Functions.**

Component Identification

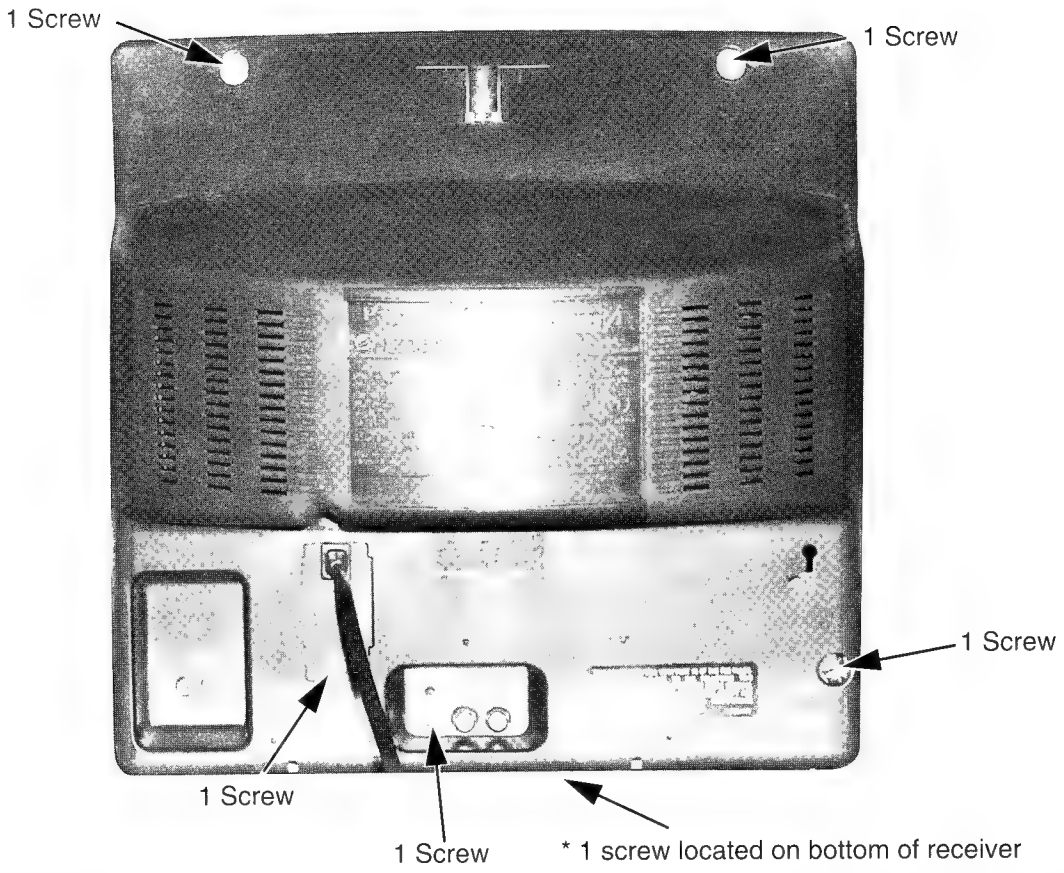


Figure 33. **Back of television (CT-13R5B, CT-13R31B, CT-13R31CB, CT-13R41B, CT-13R41CB & CT-13R51DB).**
Note: CT-13R51DB has an AC/DC connector instead of AC Cord as shown.

Component Identification (cont.)

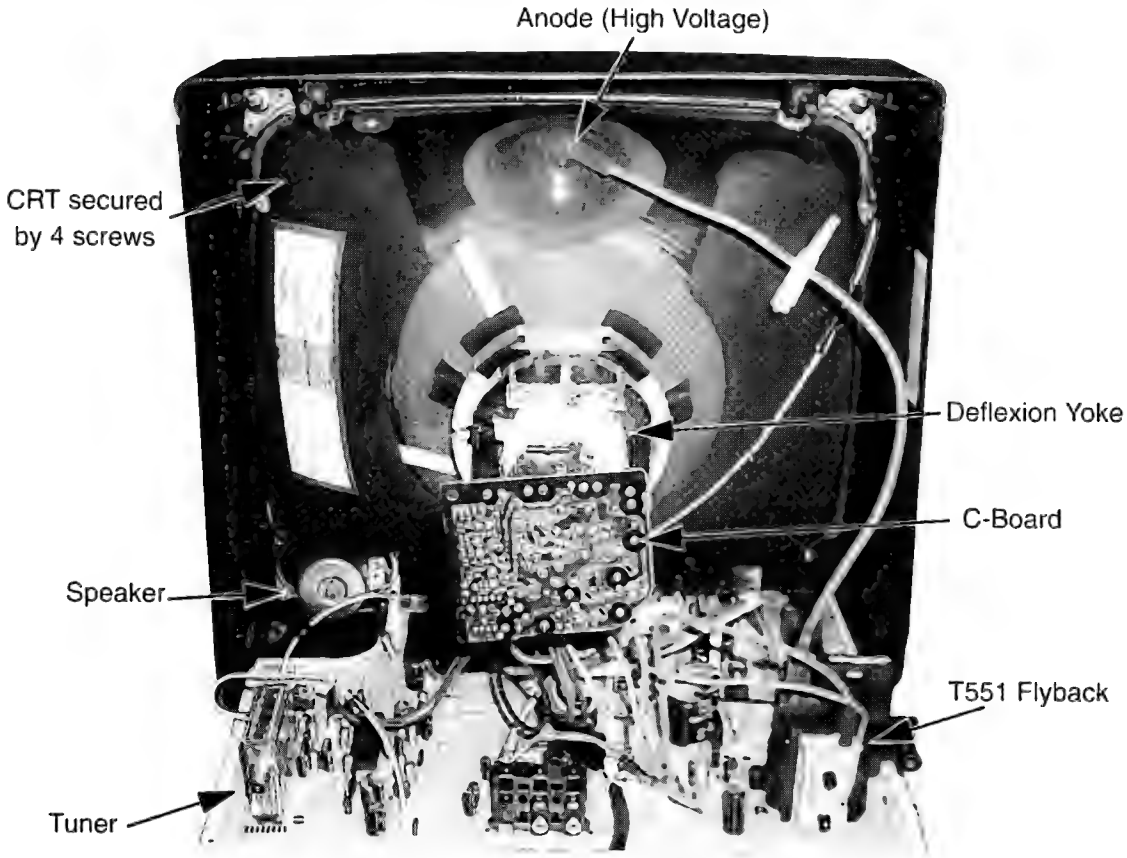


Figure 34. **Television's rear view with cover removed (CT-13R5B, CT-13R31B, CT-13R31CB, CT-13R41B & CT-13R41CB).**

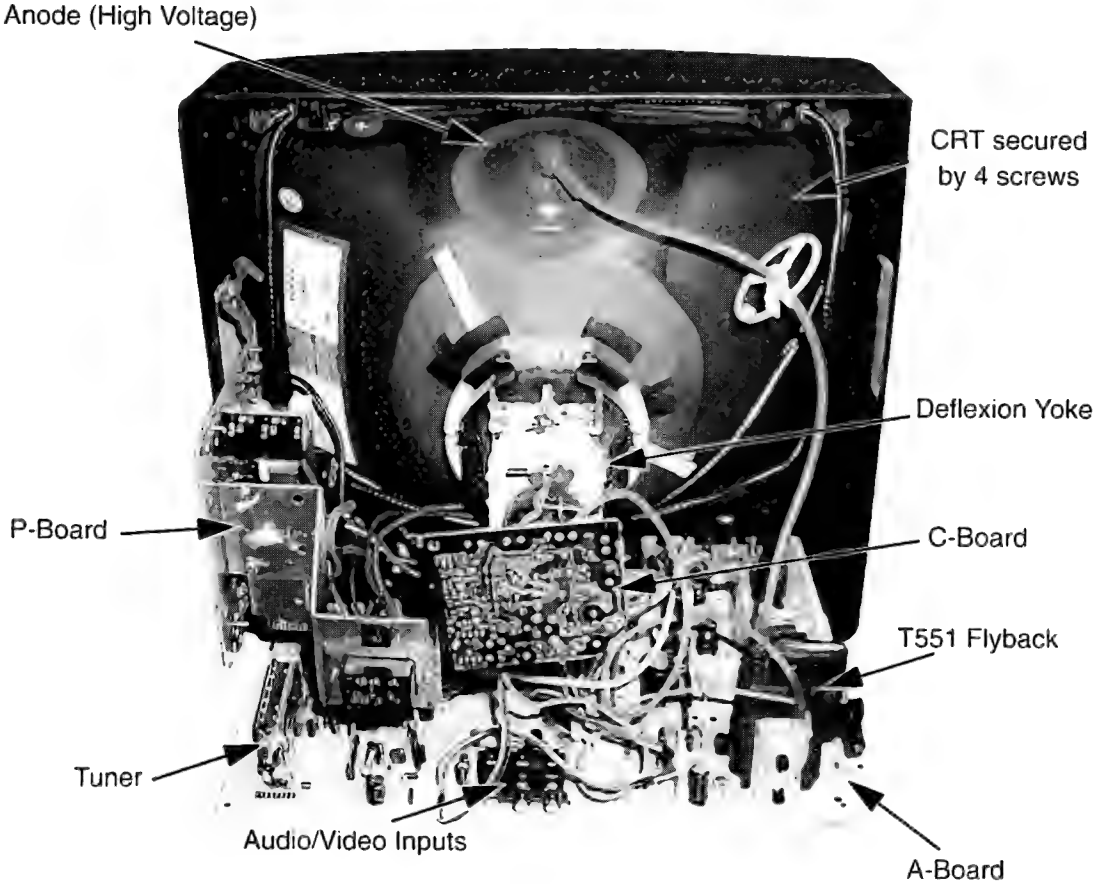


Figure 35. **Television's rear view with cover removed (CT-13R51DB).**

Component Identification (cont.)

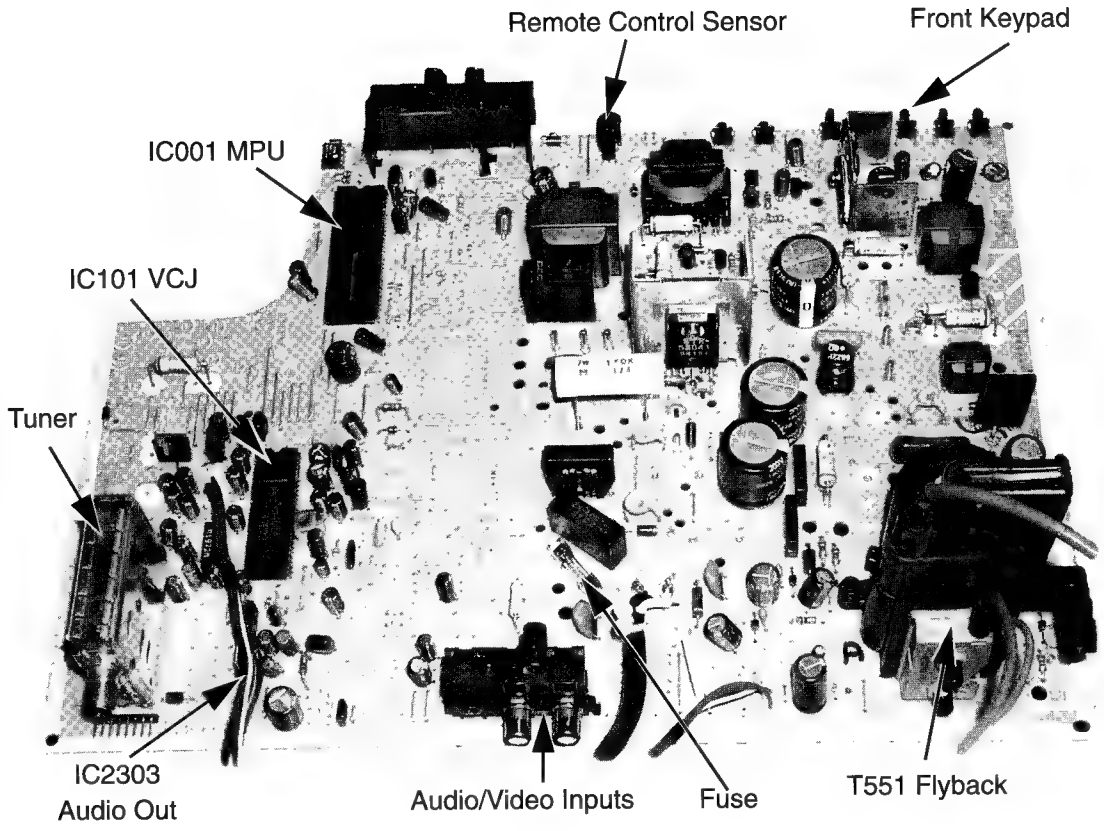


Figure 36. **Main Board (CT-13R5B, CT-13R31B, CT-13R31CB, CT-13R41B, CT-13R41CB & CT-13R51DB).**

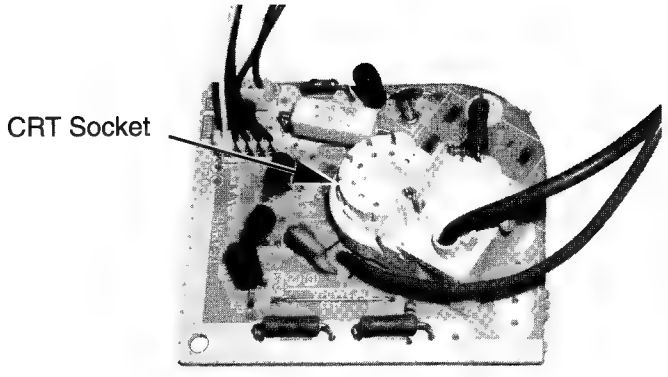


Figure 37. **C Board.**

Component Identification (cont.)

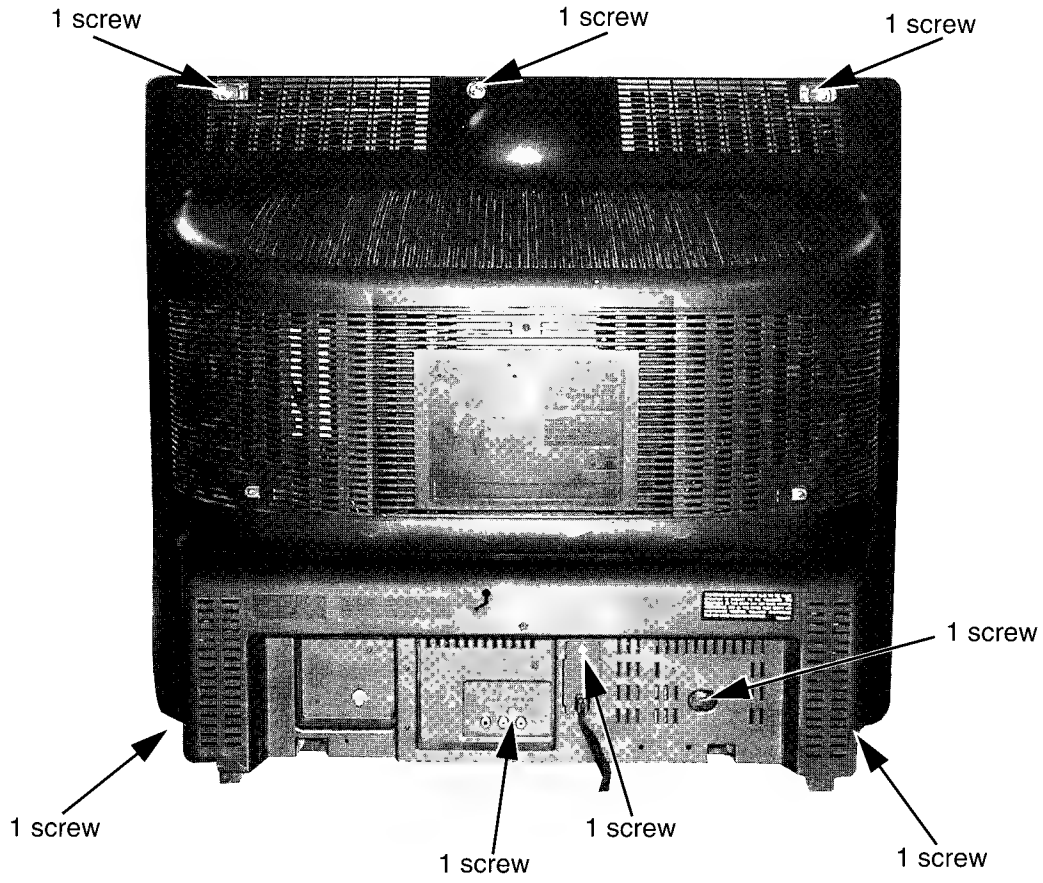


Figure 38. **Back of Television (CT-27G5B CT-27G5CB CT-27G5UB).**

Component Identification (cont.)

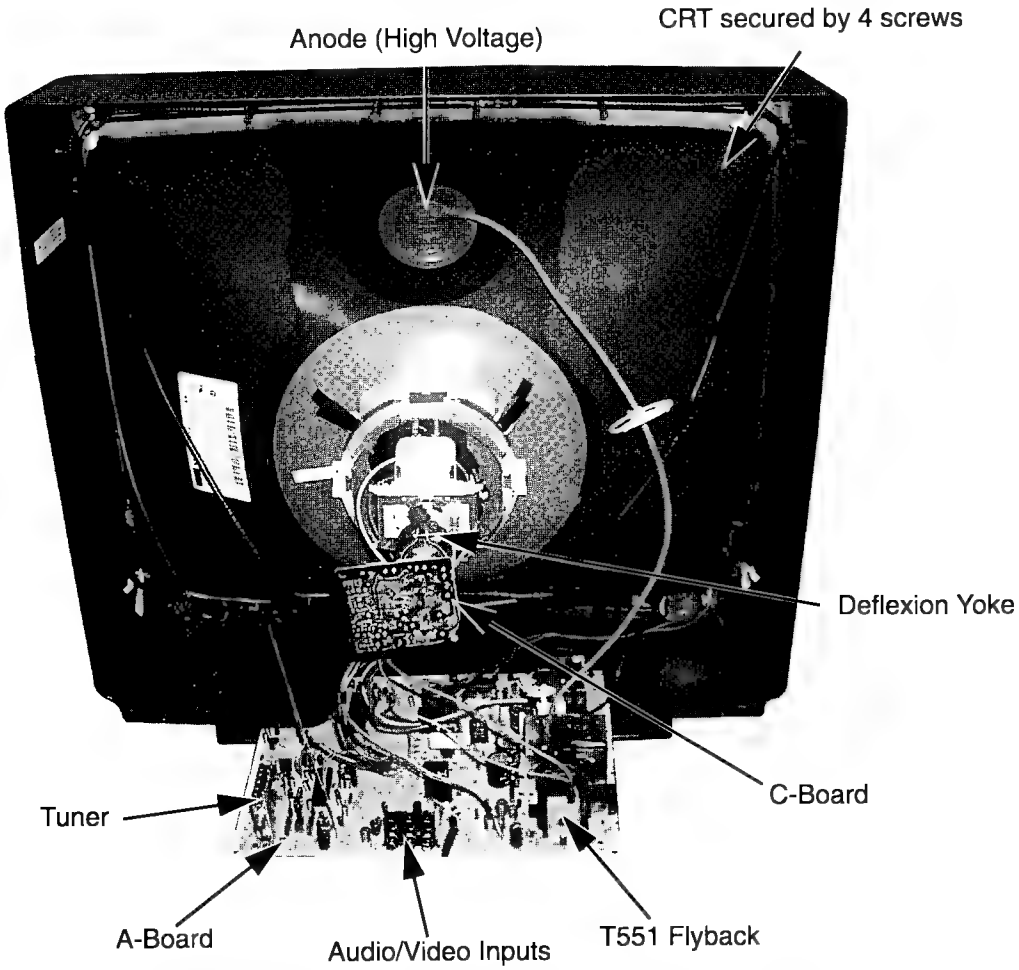


Figure 39. **Television's rear view with cover removed (CT-27G5B CT-27G5CB CT-27G5UB).**

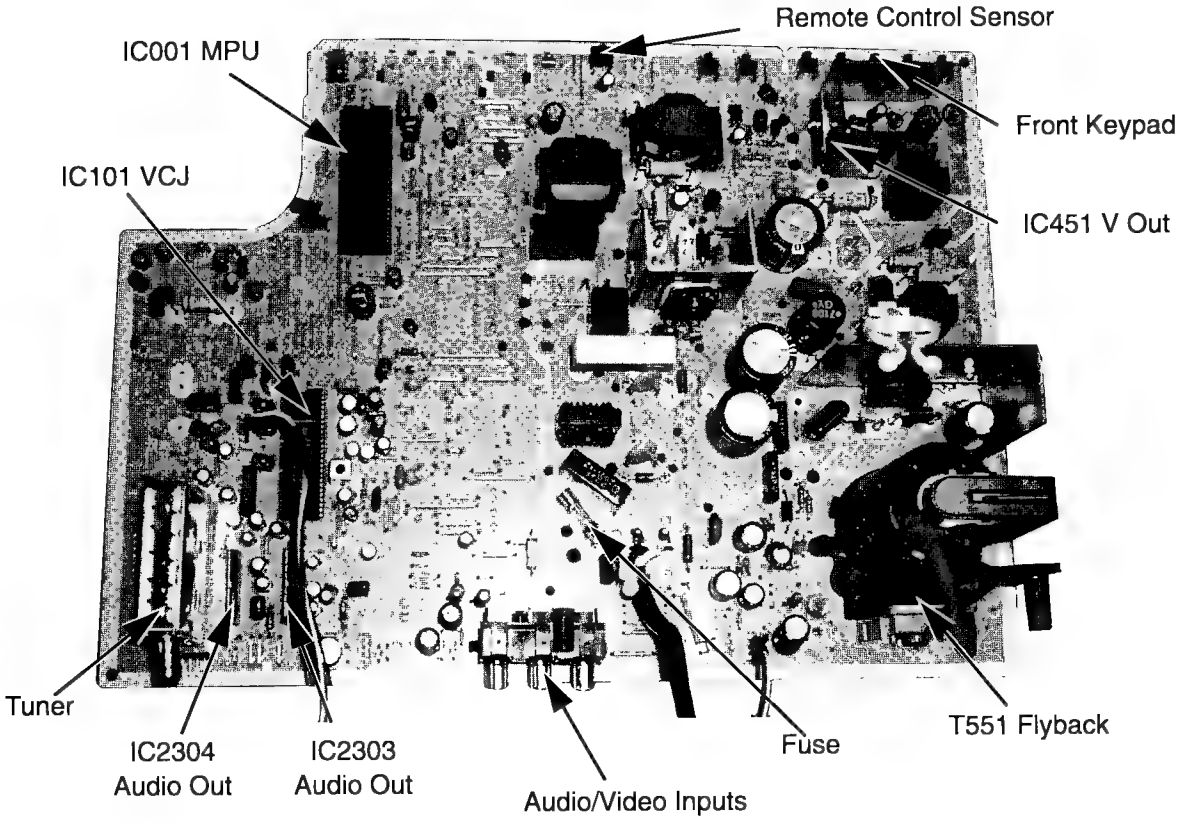


Figure 40. **Main Board (CT-27G5B CT-27G5CB CT-27G5UB).**

REPLACEMENT PARTS LIST

Models: CT-13R5B, CT-13R31B, CT-13R31CB, CT-13R41B, CT-13R41CB, CT-13R51DB, CT-27G5B, CT-27G5CB & CT-27G5UB

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
		CAPRISTORS
CRA801	**EXNFGV**	**RES-CAP**
CRA802	**EXNFGV**	**RES-CAP**
		CAPACITORS
C001	ECA1AM101	CAP,E 100UF/10V
C003	ECA1HM4R7	CAP,E 4.7UF/50V
C004	ECJ2VC1H330J	CAP,C 33PF-J-50V
C005	ECJ2VC1H330J	CAP,C 33PF-J-50V
C008	ECJ2VF1H104Z	CAP,C .1UF-Z-50V
C010	ECJ2VF1H103Z	CAP,C .01UF-Z-50V
C011	ECA1CM221	CAP,E 220UF/16V
C013	ECA0JM101	CAP,E 100UF/6.3V
C016	ECJ2VC1H101J	CAP,C 100PF-J-50V
C017	ECJ2VC1H220J	CAP,C 22PF-J-50V
C018	ECJ2VC1H220J	CAP,C 22PF-J-50V
C019	ECA0JM101	CAP,E 100UF/6.3V
C020	ECA0JM101	CAP,E 100UF/6.3V
C022	ECA1CM471	CAP,E 470UF/16V
C024	ECA1HM4R7	CAP,E 4.7UF/50V
C025	ECJ2VC1H101J	CAP,C 100PF-J-50V
C026	ECA1HM010	CAP,E 1.0UF/50V
C031	ECJ2VB1H821K	CAP,C 820PF-K-50V
C032	ECA1AM470	CAP,E 47UF/10V
C033	ECJ2VC1H101J	CAP,C 100PF-J-50V
C035	ECJ2VC1H220J	CAP,C 22PF-J-50V
C036	ECJ2VC1H220J	CAP,C 22PF-J-50V
C037	ECJ2VC1H220J	CAP,C 22PF-J-50V
C038	ECJ2VC1H220J	CAP,C 22PF-J-50V
C101	ECJ2VF1H223Z	CAP,C .022UF-Z050V
C102	ECA1EM100	CAP,E 10UF/25V
C103	ECUX1H300JCX	CAP,C 30PF-J-50V
C105	ECJ2VC1H221J	CAP,C 220PF-J-50V
C106	ECA1HMR47	CAP,E .47UF/50V
C107	ECJ2VC1H390J	CAP,C 39PF-J-50V
C108	ECA1HMR22	CAP,E .22UF/50V
C109	EEANA1E4R7B	CAP,E 4.7UF-25V
C110	ECJ2VF1H103Z	CAP,C .01UF-Z-50V
C111	ECA1EM100	CAP,E 10UF/25V
C113	ECA1EM100	CAP,E 10UF/25V
C117	ECJ2VC1H120J	CAP,C 12PF-J-50V
C151	ECA1HMR22	CAP,E .22UF/50V
C201	ECJ2VF1H103Z	CAP,C .01UF-Z-50V
C202	ECJ2VB1H562K	CAP,C .0056UF-K-50V *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
C202	ECJ2VC1H101J	CAP,C 100PF-J-50V *CT-27G5B CT-27G5CB CT-27G5UB*
C203	ECA1HM4R7	CAP,E 4.7UF/50V
C301	ECJ2VC1H390J	CAP,C 39PF-J-50V
C302	EEANA1E1R0B	CAP,E 1.0UF-25V

REF NO.	PART NO.	DESCRIPTION
C304	ECEA1HNR47U	CAP,E .47UF-50V
C305	ECA1HM4R7	CAP,E 4.7UF/50V
C306	ECA1CM221	CAP,E 220UF/16V
C308	ECQB1H823JM	CAP,P .082UF-J-50V
C309	ECA1AM101	CAP,E 100UF/10V
C310	ECA1HM4R7	CAP,E 4.7UF/50V
C311	ECA1HM4R7	CAP,E 4.7UF/50V
C312	ECA1EM220	CAP,E 22UF/25V
C314	ECJ2VF1H104Z	CAP,C .1UF-Z-50V
C351	ECJ2VB1H391K	CAP,C 390PF-K-50V *CT-27G5B CT-27G5CB CT-27G5UB*
C351	ECJ2VB1H471K	CAP,C 470PF-K-50V *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
C352	ECJ2VB1H391K	CAP,C 390PF-K-50V
C353	ECJ2VB1H471K	CAP,C 470PF-K-50V
C354	ECKD3D102KB	CAP,C .001UF-K-2KV
C357	EEANA1E1R0B	CAP,E 1.0UF-25V
C401	ECQB1H153JM	CAP,P .015UF-J-50V
C402	ECJ2VB1H471K	CAP,C 470PF-K-50V
C403	ECA1HM2R2	CAP,E 2.2UF/50V
C451	ECA1AM470	CAP,E 47UF/10V
C452	ECSF1EE105	CAP,T 1.0UF/25V
C453	EEUFC1H1R0B	CAP,E 1UF-50V *CT-27G5B CT-27G5CB CT-27G5UB*
C453	EEUFC1H2R2B	CAP,E 2.2UF-50V *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
C454	ECA1EM102	CAP,E 1000UF/25V
C455	ECA1EHG101B	CAP,E 100UF-25V *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
C455	ECA1VHG101B	CAP,E 100UF-35V *CT-27G5B CT-27G5CB CT-27G5UB*
C456	ECQB1H103JM	CAP,P .01UF-J-50V
C459	ECA1VM471	CAP,E 470UF/35V
C460	ECQM1104JZ	CAP,P .1UF-J-100V *CT-27G5B CT-27G5CB CT-27G5UB*
C462	ECA1EM100	CAP,E 10UF/25V
C502	ECQB1H223JM	CAP,P .022UF-J-50V
C503	ECA1HM2R2	CAP,E 2.2UF/50V
C504	ECJ2VC1H101J	CAP,C 100PF-J-50V
C505	ECJ2VU1H221J	CAP,C 220PF-J-50V
C506	ECA1CM221	CAP,E 220UF/16V
C507	ECJ2VC1H221J	CAP,C 220PF-J-50V *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
C507	ECJ2VC1H271J	CAP,C 270PF-J-50V *CT-27G5B CT-27G5CB CT-27G5UB*
C508	ECJ2VC1H121J	CAP,C 120PF-J-50V
C510	ECCD2H100D	CAP,C 10PF-D-500V
C511	ECKD2H821KB	CAP,C 820PF-K-500V

REPLACEMENT PARTS LIST

Models: CT-13R5B, CT-13R31B, CT-13R31CB, CT-13R41B, CT-13R41CB, CT-13R51DB, CT-27G5B, CT-27G5CB & CT-27G5UB

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
C512	ECKD2H101KB	CAP,C 100PF-K-500V *CT-27G5B CT-27G5CB CT-27G5UB*
C531	**ECA1EM220**	**CAP,E 22UF/25V**
C532	ECA1AM102	CAP,E 1000UF/10V
C533	ECJ2VF1H103Z	CAP,C .01UF-Z-50V
C534	ECJ2VF1H103Z	CAP,C .01UF-Z-50V
C551	ECA1VM331	CAP,E 330UF/35V
C552	**ECA1EM221**	**CAP,E 220UF/25V** *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
C552	**ECA1EM471**	**CAP,E 470UF/25V** *CT-27G5B CT-27G5CB CT-27G5UB*
C553	ECKD2H561KB	CAP,C 560PF-K-500V
C554	ECKD2H561KB	CAP,C 560PF-K-500V
C555	**ECA2EM220**	**CAP,E 22UF-250V**
C556	**ECA1CM471**	**CAP,E 470UF/16V**
C557	ECKD2H102KB	CAP,C .001UF-K-500V *CT-27G5B CT-27G5CB CT-27G5UB*
C557	ECKD2H222KB	CAP,C .0022UF-K-500V *CT-13R51DB CT-13R5B CT-13R31B CT-13R31C CT-13R41B CT-13R41CB*
C559	ECA1HM220	CAP,E 22UF/50V
C560	**EEANA1E2R2B**	**CAP,E 2.2UF-25V**
C561	ECKD2H561KB	CAP,C 560PF-K-500V
C563	**ECWH12H822JS**	**CAP,P .0082UF-J-1.2KV**
C564	**ECWH12H272JS**	**CAP,P .0027UF-J-1.2KV** *CT-27G5B CT-27G5CB CT-27G5UB*
C565	**ECKD3D561JB**	**CAP,C 560PF-J-2KV**
C566	**ECKD3D181JB**	**CAP,C 180PF-J-2KV**
C568	**ECWF2274JBB**	**CAP,M .27UF-J-200V** *CT-27G5B CT-27G5UB CT-27G5CB*
C569	**TACFQ2E304J**	**CAAP,M .3UF-J-200V** *CT-13R51D CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
C569	TACFR2E474J	CAP,P .47UF-J-200V *CT-27G5B CT-27G5CB CT-27G5UB*
C571	ECA1EM220	CAP,E 22UF/25V
C572	ECA1EM100	CAP,E 10UF/25V
C573	ECA1CM101	CAP,E 100UF/16V
C601	ECJ2VC1H181J	CAP,C 180PF-J-50V
C602	ECJ2VC1H680J	CAP,C 68PF-J-50V
C604	ECJ2VU1H150J	CAP,C 15PF-J-50V
C605	ECJ2VB1H332K	CAP,C .0033UF-K-50V
C606	ECA1HM010	CAP,E 1.0UF/50V
C801	**ECKDAE472ZED**	**CAP,C .4700PF-Z-250VAC**
C802	**ECKDAE472ZED**	**CAP,C .4700PF-Z-250VAC**
C805	**EC0S2DA221BB**	**CAP,E 220UF/200V** *CT-27G5B CT-27G5CB CT-27G5UB*
C805	**EC0S2DG151DG**	**CAP,E 151UF/200V** *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
C806	**EC0S2DA221BB**	**CAP,E 220UF/200V** *CT-27G5B CT-27G5CB CT-27G5UB*
C806	**EC0S2DG151DG**	**CAP,E 151UF/200V** *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
C807	ECA1HM4R7	CAP,E 4.7UF/50V
C808	ECA1CM101	CAP,E 100UF/16V
C809	**EC0S2DG151DG**	**CAP,E 151UF/200V**
C810	ECQU2A153MV	CAP,P .015UF-M-250V
C811	ECQU2A153MV	CAP,P .015UF-M-250V
C812	**ECQU2A224MV**	**CAP,P .22UF-M-250VAC**
C814	ECQB1H333JM	CAP,P .033UF-J-50V
C815	ECA1EHG101B	CAP,E 100UF-25V *CT-27G5B CT-27G5CB CT-27G5UB*
C815	ECA1EHG470B	CAP,E 47UF-25V *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
C818	ECKD3A821KB	CAP,C 820PF-K-1KVDC
C820	**ECA1JHG100B**	**CAP,E 10UF-63V**
C823	**ECA160V33UE**	**CAP,E 33UF/160V**
C824	ECKD3A331KB	CAP,C 330PF-K-1KV
C825	ECKD3A471KB	CAP,C 470PF-K-1KV
C851	**EC0S1EP123BS**	**CAP,E .012F-25V** ***CT-13R51DB***
C852	ECKD3D391JB	CAP,C 390PF-J-2KV *CT-13R51DB*
C853	ECQB1H103JM	CAP,P .01UF-J-50V *CT-13R51DB*
C854	**EC0S2DA681C4**	**CAP,E 680UF/200V** ***CT-13R51DB***
C857	ECA1CM330	CAP,E 33UF/16V *CT-13R51DB*
C858	ECQB1H104JM	CAP,P .1UF-J-50V *CT-13R51DB*
C859	ECA1CM471GB	CAP,E 470UF-16V *CT-13R51DB*
C860	ECA1CM470	CAP,E 47UF/16V *CT-13R51DB*
C861	ECQE4105KZ	CAP,P 1.0UF-K-400V *CT-13R51DB*
C864	ECKD2H472KB	CAP,C .0047UF-K-500V *CT-13R51DB*
C865	ECKD2H103ZU	CAP,C .01UF-Z-500V *CT-13R51DB*
C866	ECKD2H103KB	CAP,C .01UF-K-500V *CT-13R51DB*
C871	ECA1HM100	CAP,E 10UF/50V *CT-13R51DB*
C2201	ECA1HM4R7	CAP,E 4.7UF/50V *CT-27G5B CT-27G5CB CT-27G5UB*
C2202	ECA1HM2R2	CAP,E 2.2UF/50V *CT-27G5B CT-27G5CB CT-27G5UB*
C2203	ECA1HM4R7	CAP,E 4.7UF/50V *CT-27G5B CT-27G5CB CT-27G5UB*
C2204	AP106K016CAE	CAP,T 10UF/16V *CT-27G5B CT-27G5CB CT-27G5UB*
C2205	ECA1HMR33	CAP,E .33UF/50V *CT-27G5B CT-27G5CB CT-27G5UB*
C2206	ECQB1H223JM	CAP,P .022UF-J-50V *CT-27G5B CT-27G5CB CT-27G5UB*
C2207	AP335K016CAE	CAP,T 3.3UF/16V *CT-27G5B CT-27G5CB CT-27G5UB*
C2208	ECJ2VB1C104K	CAP,C .1UF-I-16V *CT-27G5B CT-27G5CB CT-27G5UB*
C2209	ECJ2VB1C104K	CAP,C .1UF-I-16V *CT-27G5B CT-27G5CB CT-27G5UB*
C2210	ECJ2VB1C104K	CAP,C .1UF-I-16V *CT-27G5 CT-27G5CB CT-27G5UB*

REPLACEMENT PARTS LIST

Models: CT-13R5B, CT-13R31B, CT-13R31CB, CT-13R41B, CT-13R41CB, CT-13R51DB, CT-27G5B, CT-27G5CB & CT-27G5UB

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REF NO.	PART NO.	DESCRIPTION
C2212	ECQB1H473JM	CAP,P .047UF-J-50V *CT-27G5B CT-27G5CB CT-27G5UB*
C2215	**ECA0JM101**	**CAP,E 100UF/6.3V *CT-27G5B CT-27G5CB CT-27G5UB***
C2218	ECA1HMR47	CAP,E .47UF/50V *CT-27G5B CT-27G5CB CT-27G5UB*
C2220	**EEANA1E100B**	**CAP,E 10UF-25V *CT-27G5B CT-27G5CB CT-27G5UB***
C2302	ECA1HM3R3	CAP,E 3.3UF/50V
C2303	**ECA1CM100**	**CAP,E 10UF/16V *CT-27G5B CT-27G5CB CT-27G5UB***
C2303	ECA1EM100	CAP,E 10UF/25V *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
C2304	**ECQB1H104JM**	**CAP,P .1UF-J-50V**
C2306	ECA1CM221	CAP,E 220UF/16V *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
C2306	**ECA1CM471**	**CAP,E 470UF/16V *CT-27G5B CT-27G5CB CT-27G5UB***
C2307	EEANA1E1R0B	CAP,E 1.0UF-25V
C2309	**ECA1HM010**	**CAP,E 1.0UF/50V**
C2310	ECJ2VB1H222K	CAP,C .0022UF-K-50V *CT-27G5B CT-27G5CB CT-27G5UB*
C2310	**ECJ2VB1H332K**	**CAP,C .0033UF-K-50V *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB***
C2311	ECA1HM4R7	CAP,E 4.7UF/50V
C2351	**ECA1EM102**	**CAP,E 1000UF/25V *CT-27G5B CT-27G5CB CT-27G5UB***
C2351	ECA1EM471	CAP,E 470UF/25V *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
C2352	**ECA1HM3R3**	**CAP,E 3.3UF/50V *CT-27G5B CT-27G5CB CT-27G5UB***
C2353	ECA1CM100	CAP,E 10UF/16V *CT-27G5B CT-27G5CB CT-27G5UB*
C2354	**ECQB1H104JM**	**CAP,P .1UF-J-50V *CT-27G5B CT-27G5CB CT-27G5UB***
C2356	ECA1CM471	CAP,E 470UF/16V *CT-27G5B CT-27G5CB CT-27G5UB*
C2357	**EEANA1E1R0B**	**CAP,E 1.0UF-25V *CT-27G5B CT-27G5CB CT-27G5UB***
C2358	ECJ2VB1H222K	CAP,C .0022UF-K-50V *CT-27G5B CT-27G5CB CT-27G5UB*
C3001	**ECA1HM010**	**CAP,E 1.0UF/50V *CT-27G5B CT-27G5CB CT-27G5UB***
C3001	ECA1HM100	CAP,E 10UF/50V *CT-13R51DB CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
C3002	**ECA1HM010**	**CAP,E 1.0UF/50V *CT-27G5B CT-27G5CB CT-27G5UB***
C3003	ECA1HM010	CAP,E 1.0UF/50V *CT-27G5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB CT-13R51DB CT-27G5CB CT-27G5UB*
C3005	ECJ2VB1H122K	CAP,C .0012UF--J-50V *CT-27G5B CT-27G5CB CT-27G5UB*
C3005	ECJ2VB1H272K	CAP,C .0027UF-K-50V *CT-13R51DB CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
C3006	ECJ2VB1H122K	CAP,C .0012UF--J-50V *CT-27G5B CT-27G5CB CT-27G5UB*
		DIODES
D001	ERA15-01	DIODE
D002	MA165	DIODE
D003	MA4047H	DIODE
D006	MA4330H	DIODE
D008	MA165	DIODE
D009	MA165	DIODE
D011	MA165	DIODE
D014	MA165	DIODE
D015	MA165	DIODE
D016	MA165	DIODE
D017	MA165	DIODE
D052	MA4068M	DIODE, ZENER
D451	ERA15-01	DIODE
D452	MA4047M	DIODE, ZENER
D453	MA165	DIODE
D461	MA27WTA	DIODE *CT-27G5B CT-27G5CB CT-27G5UB*
D501	MA4082L	DIODE
D531	**AS01**	**DIODE**
D532	**MA4062L**	**DIODE**
D551	**TVSRU2N**	**DIODE**
D553	**AU02**	**DIODE**
D554	**AU02**	**DIODE**
D555	MA165	DIODE
D556	MA4360H	DIODE, ZENER
D558	**RS3FS**	**DIODE *CT-27G5B CT-27G5CB CT-27G5UB***
D559	**BYD33G-113**	**DIODE *CT-27G5B CT-27G5CB CT-27G5UB***
D560	MA165	DIODE
D561	**AU02**	**DIODE**
D801	**GP15KL-042**	**DIODE**
D802	**GP15KL-042**	**DIODE**
D803	GP15KL-042	DIODE *CT-13R51DB*
D805	**TRPW5B0M050D**	**THERMISTOR *CT-27G5B CT-27G5CB CT-27G5UB***
D806	MA4047H	DIODE
D807	MA165	DIODE
D810	TAP104XM05	PTC *CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
D820	EU02V1	DIODE
D821	EU02V1	DIODE
D822	EU02V1	DIODE

REPLACEMENT PARTS LIST

Models: CT-13R5B, CT-13R31B, CT-13R31CB, CT-13R41B, CT-13R41CB, CT-13R51DB, CT-27G5B, CT-27G5CB & CT-27G5UB

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REF NO.	PART NO.	DESCRIPTION
D823	RL30A	DIODE
D824	EU02V1	DIODE
D825	**TVSSR2KL**	**DIODE, PROTECTION**
D826	EU02V1	DIODE
D827	EM02BM	DIODE *CT-13R51DB*
D829	MA165	DIODE
D851	**RL30A**	**DIODE *CT-13R51DB***
D852	RL30A	DIODE *CT-13R51DB*
D860	MA4062M	DIODE, ZENER *CT-13R51DB*
D861	AS01	DIODE *CT-13R51DB*
D865	ERA15-01	DIODE *CT-13R51DB*
D868	AS01	DIODE *CT-13R51DB*
D869	AS01	DIODE *CT-13R51DB*
D2301	MA165	DIODE
D2302	MA165	DIODE
D2312	MA4068M	DIODE, ZENER
D3001	MA165	DIODE *CT-27G5B CT-27G5CB CT-27G5UB CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB CT-13R51DB*
D3002	MA4110M	DIODE, ZENER *CT-27G5B CT-27G5CB CT-27G5UB CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB CT-13R51DB*
D3004	MA4110M	DIODE, ZENER *CT-27G5B CT-27G5CB CT-27G5UB CT-13R41B CT-13R41CB CT-13R51DB*
D3005	MA4110M	DIODE, ZENER *CT-27G5B CT-27G5CB CT-27G5UB*
D3016	MA3056M	DIODE *CT-27G5B CT-27G5CB CT-27G5UB CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB CT-13R51DB*
		FUSES
F801	**XBA2A00101**	**FUSE 6.3A 125V**
		INTEGRATED CIRCUITS
IC001	**MN1874086TL2**	**INT CKT**
IC002	24LC04BIP	INT CKT
IC003	RPM6937-V12	INT CKT
IC101	**AN5166K**	**INT CKT**
IC451	**LA7837-TV**	**INT CKT *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB***
IC451	**LA7838**	**INT CKT *CT-27G5B CT-27G5CB CT-27G5UB***
IC551	AN78M09	PLUS 9V AVR
IC552	**AN78M05**	**PLUS 5V AVR**
IC801	**PC817X2**	**INT CKT**
IC803	**STR58041A**	**INT CKT**
IC851	**STK740-020**	**INT CKT *CT-13R51DB***
IC2201	AN5829S-E1V	INT CKT *CT-27G5B CT-27G5CB CT-27G5UB*
IC2303	LA4285	INT CKT
IC2304	LA4285	INT CKT *CT-27G5B CT-27G5CB CT-27G5UB*

REF NO.	PART NO.	DESCRIPTION
		COILS
L001	TLTABT2R2K	COIL, PEAKING 2.2UH
L002	ELESN390KA	COIL, PEAKING 39UH
L003	TLTABT2R2K	COIL, PEAKING 2.2UH
L004	TLTABT2R2K	COIL, PEAKING 2.2UH
L006	EXCELSA24T	FERRITE BEAD
L008	TLTABT470K	COIL, PEAKING 47UH
L009	EXCELSA35	FERRITE BEAD
L012	EXCELSA24T	FERRITE BEAD
L013	EXCELSA35	FERRITE BEAD
L014	ELESN471JA	COIL, PEAKING 470UH
L103	ELESN150JA	COIL, PEAKING 15UH
L104	TLTABT1R0K	COIL, PEAKING 1.0UH
L105	EIV7EN053B	COIL, VCO
L106	ELESN180JA	COIL, PEAKING 18UH
L351	TLTABT101K	COIL, PEAKING *CT-27G5B CT-27G5CB CT-27G5UB*
L351	TLTABT470K	COIL, PEAKING 47UH *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
L551	**ELH5L7103**	**COIL *CT-27G5B CT-27G5CB CT-27G5UB***
L551	**TLH6622P**	**COIL, LINEARITY *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB***
L552	EXCELSA24T	FERRITE BEAD *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
L553	EXCELSA24T	FERRITE BEAD *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
L602	ELESN120JA	COIL, PEAKING 12UH
L801	**ELF15N013A**	**LINE FILTER *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB***
L801	**ELF17N017A**	**LINE FILTER *CT-27G5B* CT-27G5CB CT-27G5UB**
L802	ELEIE680KA	COIL, PEAKING 68UH
L804	EXCELSA39	FERRITE BEAD
L851	EXCELSA39	FERRITE BEAD *CT-13R51DB*
L852	EXCELSA39	FERRITE BEAD *CT-13R51DB*
L860	TLT151K991K	COIL, PEAKING 150UH *CT-13R51DB*
L2301	EXCELDR25C	FERRITE BEAD *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
L2302	TLTABT4R7K	COIL, PEAKING 4.7UH *CT-27G5B CT-27G5CB CT-27G5UB CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB CT-13R51DB*
		TRANSISTORS
Q001	2SD601ARTX	TRANSISTOR
Q002	2SC1685QRS	TRANSISTOR
Q003	2SB709ARTX	TRANSISTOR

REPLACEMENT PARTS LIST

Models: CT-13R5B, CT-13R31B, CT-13R31CB, CT-13R41B, CT-13R41CB, CT-13R51DB, CT-27G5B, CT-27G5CB & CT-27G5UB

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REF NO.	PART NO.	DESCRIPTION
Q004	2SB709ARTX	TRANSISTOR
Q302	2SD601ARTX	TRANSISTOR
Q304	2SD601ARTX	TRANSISTOR
Q351	2SC1573NC	TRANSISTOR *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
Q351	2SC3063	TRANSISTOR *CT-27G5B CT-27G5CB CT-27G5UB*
Q352	2SC1573NC	TRANSISTOR *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
Q352	2SC3063	TRANSISTOR *CT-27G5B CT-27G5CB CT-27G5UB*
Q353	2SC1573NC	TRANSISTOR *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
Q353	2SC3063	TRANSISTOR *CT-27G5B CT-27G5CB CT-27G5UB*
Q430	2SD601ARTX	TRANSISTOR
Q451	2SD601ARTX	TRANSISTOR
Q452	2SD601ARTX	TRANSISTOR
Q501	2SC1573AH	TRANSISTOR *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
Q501	2SC4212H	TRANSISTOR *CT-27G5B CT-27G5CB CT-27G5UB*
Q551	**2SD2499MA2**	**TRANSISTOR *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB***
Q551	**2SD2539MA1**	**TRANSISTOR *CT-27G5B CT-27G5CB CT-27G5UB***
Q801	2SC1685RSTA	TRANSISTOR
Q802	2SC1384RS	TRANSISTOR *CT-27G5B CT-27G5CB CT-27G5UB*
Q802	2SC1685RSTA	TRANSISTOR *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
Q804	2SA1767Q	TRANSISTOR
Q851	2SC1685QRS	TRANSISTOR *CT-13R51DB*
Q860	2SA564AQRSTA	TRANSISTOR *CT-13R51DB*
Q861	TF361MALF3	TRANSISTOR *CT-13R51DB*
Q2309	2SB709ARTX	TRANSISTOR
Q3001	2SD601ARTX	TRANSISTOR *CT-27G5B CT-27G5CB CT-27G5UB CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB CT-13R51DB*
		RELAYS
RL801	**TSEH0005**	**RELAY**
		RESISTORS
R002	ERJ6GEYJ182	RES,M 1.8K-J-1/10
R003	ERJ6GEYJ562	RES,M 5.6K-J-1/10
R004	ERDS1TJ181	RES,C 180-J-1/2
R005	ERJ6GEYJ101	RES,M 100-J-1/10
R006	ERJ6GEYJ102	RES,M 1K-J-1/10
R007	ERJ6GEYJ102	RES,M 1K-J-1/10

REF NO.	PART NO.	DESCRIPTION
R008	ERJ6GEYJ562	RES,M 5.6K-J-1/10
R010	ERJ6GEYJ154	RES,M 150K-J-1/10
R011	ERJ6GEYJ684	RES,M 680K-J-1/10
R012	ERJ6GEYJ473	RES,M 47K-J-1/10
R014	ERJ6GEYJ472	RES,M 4.7K-J-1/10
R015	ERJ6GEYJ472	RES,M 4.7K-J-1/10
R016	ERJ6GEYJ472	RES,M 4.7K-J-1/10
R017	ERJ6GEYJ472	RES,M 4.7K-J-1/10
R020	ERJ6GEYJ564	RES,M 560K-J-1/10
R021	ERJ6GEYJ101	RES,M 100-J-1/10
R022	ERJ6GEYJ101	RES,M 100-J-1/10
R023	ERJ6GEYJ102	RES,M 1K-J-1/10
R025	ERJ6GEYJ223	RES,M 22K-J-1/10
R026	ERJ6GEYJ103	RES,M 10K-J-1/10 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R027	ERJ6GEYJ103	RES,M 10K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R027	ERJ6GEYJ223	RES,M 22K-J-1/10 *CT-13R5B*
R028	**ERJ6GEYJ103**	**RES,M 10K-J-1/10**
R030	ERJ6GEYJ102	RES,M 1K-J-1/10
R032	ERJ6ENF1002	RES,M 10K-F-1/10
R033	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R034	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R035	ERJ6GEYJ332	RES,M 3.3K-J-1/10
R036	ERJ6GEYJ562	RES,M 5.6K-J-1/10
R037	ERJ6GEYJ103	RES,M 10K-J-1/10
R038	ERJ6GEYJ223	RES,M 22K-J-1/10
R039	ERJ6GEYJ102	RES,M 1K-J-1/10
R046	ERJ6GEYJ102	RES,M 1K-J-1/10
R048	ERJ6GEYJ221	RES,M 220-J-1/10
R049	ERJ6GEYJ221	RES,M 220-J-1/10
R053	ERJ6GEYJ103	RES,M 10K-J-1/10
R055	ERJ6GEYJ103	RES,M 10K-J-1/10
R060	ERJ6GEYJ102	RES,M 1K-J-1/10
R065	ERJ6GEYJ471	RES,M 470-J-1/10
R066	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R067	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R068	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R070	ERJ6GEYJ101	RES,M 100-J-1/10
R101	ERJ6GEYJ750	RES,M 75-J-1/10
R102	ERJ6GEYJ683	RES,M 68K-J-1/10
R103	ERJ6GEYJ183	RES,M 18K-J-1/10
R104	ERJ6GEYJ561	RES,M 560-J-1/10
R105	ERJ6GEYJ561	RES,M 560-J-1/10
R107	ERJ6GEYJ222	RES,M 2.2K-J-1/10
R108	ERJ6GEYJ471	RES,M 470-J-1/10
R152	ERJ6GEYJ183	RES,M 18K-J-1/10
R153	ERJ6GEYJ223	RES,M 22K-J-1/10
R154	ERJ6GEYJ393	RES,M 39K-J-1/10

REPLACEMENT PARTS LIST

Models: CT-13R5B, CT-13R31B, CT-13R31CB, CT-13R41B, CT-13R41CB, CT-13R51DB, CT-27G5B, CT-27G5CB & CT-27G5UB

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
R201	ERJ6GEYJ471	RES,M 470-J-1/10
R202	ERJ6GEYJ682	RES,M 6 8K-J-1/10
R203	ERJ6GEYJ222	RES,M 2.2K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R251	ERDS1TJ181	RES,C 180-J-1/2 *CT-13R5B*
R303	ERJ6GEYJ682	RES,M 6.8K-J-1/10
R304	ERJ6GEYJ332	RES,M 3.3K-J-1/10
R305	ERJ6ENF3001	RES,M 3K-F-1/10
R306	ERJ6ENF1651	REES,M 1.65K-F-1/10 *CT-13R51D CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R306	ERJ6ENF1801	RES,M 1.8K-F-1/10W *CT-27G5B CT-27G5CB CT-27G5UB*
R307	ERJ6GEYJ564	RES,M 560K-J-1/10
R308	ERJ6GEYJ102	RES,M 1K-J-1/10
R309	ERJ6GEYJ153	RES,M 15K-J-1/10 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R309	ERJ6GEYJ683	RES,M 68K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R310	ERJ6GEYJ273	RES,M 27K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R310	ERJ6GEYJ333	RES,M 33K-J-1/10 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R311	ERJ6GEYJ185	RES,M 1.8MEG-J-1/10W
R317	ERJ6GEYJ684	RES,M 680K-J-1/10
R319	ERJ6GEYJ122	RES,M 1 2K-J-1/10
R320	ERJ6GEYJ102	RES,M 1K-J-1/10
R351	ERG1ANJP123H	RES,M 12K-J-1W *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R351	ERG2FJ123H	RES,M 12K-J-2W *CT-27G5B CT-27G5CB CT-27G5UB*
R352	ERG1ANJP123H	RES,M 12K-J-1W *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R352	ERG2FJ123H	RES,M 12K-J-2W *CT-27G5B CT-27G5CB CT-27G5UB*
R353	ERG2FJ123H	RES,M 12K-J-2W *CT-27G5B CT-27G5CB CT-27G5UB*
R354	ERDS1TJ272	RES,C 2.7K-J-1/2 *CT-27G5B CT-27G5CB CT-27G5UB*
R355	ERDS1TJ272	RES,C 2.7K-J-1/2 *CT-27G5B CT-27G5CB CT-27G5UB*
R356	ERDS1TJ272	RES,C 2.7K-J-1/2 *CT-27G5B CT-27G5CB CT-27G5UB*
R357	ERJ6GEYJ301	RES,M 300-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R357	ERJ6GEYJ361	RES,M 360-J-1/10 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R358	ERJ6GEYJ301	RES,M 300-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R358	ERJ6GEYJ361	RES,M 360-J-1/10 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R359	ERJ6GEYJ301	RES,M 300-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R359	ERJ6GEYJ361	RES,M 360-J-1/10 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R360	ERJ6GEYJ102	RES,M 1K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R360	ERJ6GEYJ182	RES,M 1.8K-J-1/10 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R361	ERJ6GEYJ102	RES,M 1K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R361	ERJ6GEYJ182	RES,M 1.8K-J-1/10 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R362	ERJ6GEYJ102	RES,M 1K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R362	ERJ6GEYJ182	RES,M 1.8K-J-1/10 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R363	ERJ6GEYJ101	RES,M 100-J-1/10
R364	ERJ6GEYJ101	RES,M 100-J-1/10
R365	ERJ6GEYJ101	RES,M 100-J-1/10
R369	ERG1ANJP123H	RES,M 12K-J-1W *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R374	ERDS1TJ272	RES,C 2.7K-J-1/2 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R375	ERDS1TJ272	RES,C 2.7K-J-1/2 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R376	ERDS1TJ272	RES,C 2.7K-J-1/2 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R401	ERJ6GEYJ102	RES,M 1K-J-1/10
R430	ERJ6GEYJ103	RES,M 10K-J-1/10
R432	ERJ6GEYJ102	RES,M 1K-J-1/10
R451	ERDS1FJ1R0	RES,C 1.0-J-1/2 *CT-27G5B CT-27G5CB CT-27G5UB*
R451	ERDS1FJ1R8	RES,C 1.8-J-1/2 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R453	ERJ6GEYJ224	RES,M 220K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R454	ERJ6GEYJ473	RES,M 47K-J-1/10
R455	ERJ6GEYJ153	RES,M 15K-J-1/10 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R455	ERJ6GEYJ183	RES,M 18K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R456	ERJ6GEYJ223	RES,M 22K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*

REPLACEMENT PARTS LIST

Models: CT-13R5B, CT-13R31B, CT-13R31CB, CT-13R41B, CT-13R41CB, CT-13R51DB, CT-27G5B, CT-27G5CB & CT-27G5UB

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
R456	ERJ6GEYJ682	RES,M 6.8K-J-1/10 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R457	ERJ6GEYJ152	RES,M 1.5K-J-1/10
R458	ERJ6GEYJ223	RES,M 22K-J-1/10 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R458	ERJ6GEYJ333	RES,M 33K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R459	ERJ6GEYJ683	RES,M 68K-J-1/10
R460	ERDS2TJ102	RES,C 1K-J-1/4
R461	ERDS2TJ152	RES,C 1.5K-J-1/4 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R462	ERJ6GEYJ473	RES,M 47K-J-1/10
R463	ERJ6GEYJ473	RES,M 47K-J-1/10
R464	ERDS1FJ1R5	RES,C 1.5-J-1/2 *CT-27G5B CT-27G5CB CT-27G5UB*
R465	ERJ6GEYJ103	RES,M 10K-J-1/10
R466	ERJ6GEYJ103	RES,M 10K-J-1/10
R467	ERJ6GEYJ104	RES,M 100K-J-1/10
R468	ERJ6GEYJ101	RES,M 100-J-1/10
R469	ERJ6GEYJ220	RES,M 22-J-1/10
R470	ERDS2TJ152	RES,C 1.5K-J-1/4 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R471	ERJ6GEYJ223	RES,M 22K-J-1/10
R501	ERJ6GEYJ102	RES,M 1K-J-1/10
R502	ERJ6GEYJ562	RES,M 5.6K-J-1/10
R503	ERJ6GEYJ822	RES,M 8.2K-J-1/10
R504	ERJ6GEYJ561	RES,M 560-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R504	ERJ6GEYJ821	RES,M 820-J-1/10 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R505	ERJ6GEYJ472	RES,M 4.7K-J-1/10 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B/DB*
R505	ERJ6GEYJ682	RES,M 6.8K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R506	ERJ6GEYJ182	RES,M 1.8K-J-1/10
R507	ERJ6GEYJ392	RES,M 3.9K-J-1/10
R508	ERJ6GEYJ562	RES,M 5.6K-J-1/10
R509	ERDS2TJ331	RES,C 330-J-1/4
R510	**ERG3FJ332H**	**RES,M 2.3K-J-3W *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB***
R510	**ERG3FJ362H**	**RES,M 3.6K-J-3W *CT-27G5B CT-27G5CB CT-27G5UB***
R511	**ERG3FJ272H**	**RES,M 2.7K-J-3W *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB***
R511	**ERG3FJ362H**	**RES,M 3.6K-J-3W *CT-27G5B CT-27G5CB CT-27G5UB***

REF NO.	PART NO.	DESCRIPTION
R512	ERG2FJ392H	RES,M 3.9K-J-2W *CT-27G5B CT-27G5CB CT-27G5UB*
R512	ERG2FJ562H	RES,M 5.6K-J-2W *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R531	**ERD25FJ470**	**RES,C 47-J-1/4**
R532	**ERJ6ENF5602**	**RES,M 56K-F-1/10 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB***
R532	**ERJ6ENF6652**	**RES,M 66.5K-F-1/10 *CT-27G5B CT-27G5CB CT-27G5UB***
R533	**ERJ6ENF2102**	**RES,M 21K-F-1/10 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB***
R533	**ERJ6ENF2402**	**RES,M 24K-F-1/10 *CT-27G5B CT-27G5CB CT-27G5UB***
R536	ERJ6GEYJ223	RES,M 22K-J-1/10
R537	ERJ6GEYJ473	RES,M 47K-J-1/10
R551	**ERDS1FJ1R0**	**RES,C 1.0-J-1/2**
R552	**ERDS1FJ1R0**	**RES,C 1.0-J-1/2**
R553	ERDS1FJ1R0	RES,C 1.0-J-1/2
R555	**ERDS1FJ101**	**RES,C 100-J-1/2 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB***
R556	ERJ6GEYJ272	RES,M 2.7K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R556	ERJ6GEYJ472	RES,M 4.7K-J-1/10 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R557	ERJ6GEYJ103	RES,M 10K-J-1/10
R558	ERQ1CKPR56	RES,F .56-K-1W *CT-27G5B CT-27G5CB CT-27G5UB*
R558	ERQ2CJP1R8	RES,F 1.8-J-2W *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R559	ERG2FJ683H	RES,M 12K-J-2W
R560	ERDS1FJ182	RES,C 1.8K-J-1/2 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R560	ERG2FJ122H	RES,M 12K-J-2W *CT-27G5B CT-27G5CB CT-27G5UB*
R561	ERG2FJ102H	RES,M 1K-J-2W *CT-27G5B CT-27G5CB CT-27G5UB*
R562	ERG3FJ680H	RES,M 68-J-3W *CT-27G5B CT-27G5CB CT-27G5UB*
R562	ERG3FJ820H	RES,M 82-J-3W *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R563	ERDS2TJ184	RES,C 180K-J-1/4 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R563	ERDS2TJ393	RES,C 39K-J-1/4 *CT-27G5B CT-27G5CB CT-27G5UB*
R564	ERDS2TJ104	RES,C 100K-J-1/4 *CT-27G5B CT-27G5CB CT-27G5UB*

REPLACEMENT PARTS LIST

Models: CT-13R5B, CT-13R31B, CT-13R31CB, CT-13R41B, CT-13R41CB, CT-13R51DB, CT-27G5B, CT-27G5CB & CT-27G5UB

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
R564	ERDS2TJ154	RES,C 150K-J-1/4 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R565	ERJ6GEYJ103	RES,M 10K-J-1/10
R567	ERG2FJ471H	RES,M 470-J-2W *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R602	ERJ6GEYJ331	RES,M 330-J-1/10
R603	ERJ6GEYJ331	RES,M 330-J-1/10
R604	ERJ6GEYJ331	RES,M 330-J-1/10
R611	ERJ6GEYJ333	RES,M 33K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R612	ERJ6GEYJ333	RES,M 33K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R613	ERJ6GEYJ333	RES,M 33K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R614	ERJ6GEYJ332	RES,M 3.3K-J-1/10
R801	**ERF7ZK1R5**	**RES,W 1.5-K-7W**
R805	ERDS2TJ274	RES,C 270K-J-1/4
R806	ERDS2TJ274	RES,C 270K-J-1/4
R808	ERDS1FJ1R0	RES,C 1.0-J-1/2
R809	ERDS1FJ1R0	RES,C 1.0-J-1/2 *CT-27G5B CT-27G5CB CT-27G5UB*
R810	ERDS1FJ272	RES,C 2.7K-J-1/2
R812	ERDS1TJ183	RES,C 18K-J-1/2
R813	ERJ6GEYJ562	RES,M 5.6K-J-1/10
R815	**ERC12ZGM825**	**RES,S 8.2MEG-M-1/2**
R817	**ERX3FJ4R7**	**RES,M 4.7-J-3W *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB***
R820	ERJ6GEYJ153	RES,M 15K-J-1/10
R821	ERJ6GEYJ392	RES,M 3.9K-J-1/10
R822	ERD50FJ474	RES,C 470K-J-1/2W
R823	ERDS2TJ222	RES,C 2.2K-J-1/4
R824	ERG3FJ390	RES,M 39-J-3W *CT-27G5B CT-27G5CB CT-27G5UB*
R824	ERG3FJ680	RES,M 68-J-3W *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R825	ERJ6GEYJ102	RES,M 1K-J-1/10
R826	**ERF2AKR22**	**RES,W .22-K-2W *CT-27G5B CT-27G5CB CT-27G5UB***
R826	**ERF2AKR33**	**RES,W .33-K-2W *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB***
R827	ERDS1FJ561	RES,C 560-J-1/2
R828	ERG3FJ470H	RES,M 47-J-3W
R829	ERQ14AJ180	RES,F 180-J-1/4 *CT-27G5B CT-27G5CB CT-27G5UB*
R829	ERQ14AJ270	RES,F 27-J-1/4 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R854	ER0S2CKF1003	RES,M 100K-F-1/4 *CT-13R51DB*
R855	EVND2AA03B24	CONTROL 20K *CT-13R51DB*
R856	ER0S2CKF4300	RES,M 430-F-1/4W *CT-13R51DB*
R857	ERF5ZJ681	RES,W 680-J-5W *CT-13R51DB*
R858	ERG1SJ272P	RES,M 2.7K-J-1W *CT-13R51DB*
R860	ERDS2TJ152	RES,C 1.5K-J-1/4 *CT-13R51DB*
R861	ERDS2TJ103	RES,C 10K-J-1/4 *CT-13R51DB*
R862	ERDS2TJ272	RES,C 2.7K-J-1/4 *CT-13R51DB*
R863	ERDS2TJ471	RES,C 470-J-1/4 *CT-13R51DB*
R864	ERDS2TJ102	RES,C 1K-J-1/4 *CT-13R51DB*
R865	ERDS1TJ105	RES,C 1MEG-J-1/2 *CT-13R51DB*
R867	ERD25FJ150	RES,C 15-J-1/4 *CT-13R51DB*
R869	ERDS2TJ224	RES,C 220K-J-1/4 *CT-13R51DB*
R870	ERDS2TJ564	RES,C 560K-J-1/4 *CT-13R51DB*
R875	ERDS2TJ103	RES,C 10K-J-1/4 *CT-13R51DB*
R876	ERDS2TJ103	RES,C 10K-J-1/4 *CT-13R51DB*
R877	ERDS2TJ272	RES,C 2.7K-J-1/4 *CT-13R51DB*
R878	ERDS2TJ152	RES,C 1.5K-J-1/4 *CT-13R51DB*
R2201	ERJ6GEYJ224	RES,M 220K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R2206	ERJ6GEYJ102	RES,M 1K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R2207	ERJ6GEYJ102	RES,M 1K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R2220	ERJ6GEYJ101	RES,M 100-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R2301	ERQ2CJP120	RES,F 12-J-2W
R2303	ERD25FJ1R0	RES,C 1.0-J-1/4
R2306	ERJ6GEYJ682	RES,M 6.8K-J-1/10
R2311	ERJ6GEYJ332	RES,M 3.3K-J-1/10
R2312	ERJ6GEYJ682	RES,M 6.8K-J-1/10
R2313	ERJ6GEYJ683	RES,M 68K-J-1/10
R2314	ERJ6GEYJ104	RES,M 100K-J-1/10
R2317	ERJ6GEYJ681	RES,M 680-J-1/10
R2318	ERJ6GEYJ103	RES,M 10K-J-1/10
R2319	ERDS2TJ562	RES,C 5.6K-J-1/4
R2320	ERJ6GEYJ181	RES,M 180-J-1/10 *CT-13R51DB CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
R2321	ERJ6GEYJ101	RES,M 100-J-1/10
R2322	ERJ6GEYJ472	RES,M 4.7K-J-1/10
R2353	ERD25FJ1R0	RES,C 1.0-J-1/4 *CT-27G5B CT-27G5CB CT-27G5UB*
R2356	ERJ6GEYJ682	RES,M 6.8K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R3001	ERJ6GEYJ473	RES,M 47K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB CT-13R51DB*
R3002	ERJ6GEYJ104	RES,M 100K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB CT-13R51DB*

REPLACEMENT PARTS LIST

Models: CT-13R5B, CT-13R31B, CT-13R31CB, CT-13R41B, CT-13R41CB, CT-13R51DB, CT-27G5B, CT-27G5CB & CT-27G5UB

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
R3005	ERJ6GEYJ750	RES,M 75-J-1/10*CT-27G5B CT-27G5CB CT-27G5UB CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB CT-13R51DB*
R3006	ERJ6GEYJ391	RES,M 390-J-1/10*CT-27G5B CT-27G5CB CT-27G5UB CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB CT-13R51DB*
R3009	ERJ6GEYJ682	RES,M 6.8K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB CT-13R51DB*
R3010	ERJ6GEYJ334	RES,M 330K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB CT-13R31B CT-13R31CB CT-13R41B CT-13R41CBCT-13R51DB*
R3011	ERJ6GEYJ682	RES,M 6.8K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R3012	ERJ6GEYJ334	RES,M 330K-J-1/10 *CT-27G5B CT-27G5CB CT-27G5UB*
R3013	ERJ6GEYJ682	RES,M 6.8K-J-1/10 *CT-13R51DB CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
		SWITCHES
S001	EVQPF106K	SWITCH
S002	EVQPF106K	SWITCH
S003	EVQPF106K	SWITCH
S004	EVQPF106K	SWITCH
S005	EVQPF106K	SWITCH
S008	EVQPF106K	SWITCH
S009	EVQPF106K	SWITCH *CT-27G5B CT-27G5CB CT-27G5UB CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB CT-13R51DB*
		TRANSFORMERS
T001	**TLP16297**	**TRANSFORMER, POWER SUPPLY**
T501	**TLH15412**	**TRANSFORMER, HORIZONTAL DRIVER *CT-13R5 CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB CT-13R51DB***
T501	**TLH15452**	**TRANSFORMER, HORIZONTAL DRIVER *CT-27G5B CT-27G5CB CT-27G5UB***
T502	**ETE19Z30AY**	**TRANSFORMER, HORIZONTAL COUPLING**
T551	**KFT2AB118F**	**TRANSFORMER, FLYBACK *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB***
T551	**KFT4AB143F**	**TRANSFORMER, FLYBACK *CT-27G5B CT-27G5CB CT-27G5UB***
T801	**ETS25AD139NC**	**TRANSFORMER *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB***
T801	**ETS28AE219NC**	**TRANSFORMER *CT-27G5B CT-27G5CB CT-27G5UB***
T852	ETS29AK1X9NC	TRANSFORMER *CT-13R51DB*
		CRYSTALS/FILTERS
X001	TSS2080MX	CRYSTAL, 12 MHZ CLOCK
X101	M1972M	FILTER
X102	EFCS4R5MW5BA	FILTER, BANDPASS
X201	EFCS4R5MS4	FILTER 4.5MHZ BANDPASS *CT-13R51DB CT-13R5BM CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
X201	SFSH4R5MDB	CRYSTAL *CT-27G5B CT-27G5CB CT-27G5UB*
X501	TAFCSB503F38	CRYSTAL, CLOCK
X601	TSS2AA001	CRYSTAL, 3.58MHZ
		OTHERS
M001	ETC33X82NA	YOKE, CONVERGENCE *CT-27G5B CT-27G5CB CT-27G5UB*
M002	ETC26X42NA	YOKE, CONVERGENCE *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
TNR001	**ENV56D51G3**	**TUNER**
M003	EUR501451	REMOTE CONTROL *CT-13R41B CT-13R41CB*
M004	EUR501452	REMOTE CONTROL *CT-13R5B*
M005	EUR501450	REMOTE CONTROL *CT-27G5B CT-27G5CB CT-27G5UB CT-13R31B CT-13R31CB CT-13R51DB*
M006	UR50EC1190A	BATTERY COVER, REMOTE CONTROL *CT-13R5B CT-13R31B CT-13R31CB CT-13R51DB CT-27G5B CT-27G5CB CT-27G5UB*
M007	UR50EC1190B	BATTERY COVER, REMOTE CONTROL *CT-13R41B CT-13R41CB*
M008	**M68LGL061X**	**CRT 27" *CT-27G5B CT-27G5CB CT-27G5UB***
M009	**37GDA85X(M)**	**CRT 13" *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB***
M010	TAS2AA0010	SPEAKER 16-OHM 3W *CT-27G5B CT-27G5CB CT-27G5UB*
M011	TAS2AA0014	SPEAKER 16-OHM 1.5W *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
M012	TBM2A10141	BADGE, PANASONIC *CT-27G5B CT-27G5CB CT-27G5UB*
M013	TBM2A30832	BADGE, PANASONIC *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
M014	TBX2AA00701G	BUTTON, 7-KEY *CT-13R31B CT-13R31CB CT-13R51*
M015	TBX2AA00702G	BUTTON, 7-KEY *CT-13R41B CT-13R41CB*
M016	TBX2AA00801G	BUTTON, 7-KEY *CT-27G5B CT-27G5CB CT-27G5UB*
M017	TBX2AA1101GM	BUTTON, 7-KEY *CT-13R5B*
M018	TJB2A20701	ANTENNA CONVERTER 75-300 *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
M019	**TJSC00300**	**SOCKET, CRT *CT-27G5B CT-27G5CB CT-27G5UB***

REPLACEMENT PARTS LIST

Models: CT-13R5B, CT-13R31B, CT-13R31CB, CT-13R41B, CT-13R41CB, CT-13R51DB, CT-27G5B, CT-27G5CB & CT-27G5UB

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
M020	**TJSC00200**	**SOCKET, CRT** *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
M021	TJS1A7010	CONNECTOR EARPHONE JACK *CT-13R5B*
M022	TKX69202	STUCK BOSS *CT-13R51DB*
DY	**TLY2AA006**	**DEFLECTION YOKE** *CT-27G5B CT-27G5CB CT-27G5UB*
DY	**0LY15311F**	**YOKE, DEFLECTION** *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
M023	TMM2A30702	WEDGE, YOKE
M024	TQB2AA0326	MANUAL OWNERS *CT-27G5B CT-27G5UB*
M025	TQB2AA7057	REMOTE GUIDE *CT-27G5B CT-27G5CB CT-27G5UB*
M026	TQB2AA0326	MANUAL, OWNERS *CT-13R5B CT-13R31B CT-13R41B*
M027	TQB2AA0350	MANUAL, OWNERS *CT-13R51DB CT-13R31CB CT-13R41CB CT-27G5CB*
M028	TQB2AA7075	V-CHIP INSTRUCTIONS *CT-13R5B CT-13R31B CT-13R41B CT-27G5B CT-27G5UB*
M029	TQB2AA7075	V-CHIP INSTRUCTIONS *CT-13R41CB CT-13R51DB CT-13R31CB CT-27G5CB*
M030	TQB2AA7055	REMOTE GUIDE *CT-13R5B*
M031	TQB2AA7057	REMOTE GUIDE *CT-13R41B CT-13R41CB CT-13R31B CT-13R31CB CT-13R51DB*
M032	TSA2AA0001	ANTENNA, DIPOLE *CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB CT-13R51DB*
DEG	**0LK19031-1A**	**COIL, DEGAUSSING 13" CT-13R51DB**
DEG	**TSP2AA006**	**COIL, DEGAUSSING 27"** *CT-27G5B CT-27G5CB CT-27G5UB*
DEG	**TSP2AA010**	**COIL, DEGAUSSING 13"** *CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
M033	**TSX2AA0031**	**AC LINE CORD** *CT-13R51DB*
M034	**TSX2AA0181**	**LINE CORD (SPT2)** *CT-13R51DB*

REF NO.	PART NO.	DESCRIPTION
M035	**TSX2AA0111**	**AC LINE CORD** *CT-27G5B CT-27G5CB CT-27G5UB*
M036	**TSX2AA0131**	**LINE CORD (SPT2)** *CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
M037	TXFKU0198SER	ASSY. CABINET BACK *CT-13R5B*
M038	TXFKU01ASER	ASSY. CABINET BACK *CT-27G5B CT-27G5UB*
M039	TXFKU02BSER	ASSY. CABINET BACK *CT-13R31CB*
M040	TXFKU03BSER	ASSY. CABINET BACK *CT-27G5CB*
M041	TXFKU0597SER	ASSY. CABINET BACK *CT-13R1B CT-13R41B*
M042	TXFKU09ASER	ASSY. CABINET BACK *CT-13R41CB*
M043	TXFKU2397SER	ASSY. CABINET BACK *CT-13R51DB*
M044	TXFKY02ASER	ASSY. CABINET FRONT *CT-27G5B CT-27G5CB CT-27G5UB*
M045	TXFKY088SER	ASSY. CABINET FRONT *CT-13R5B*
M046	TXFKY09ASER	ASSY. CABINET FRONT *CT-13R31B CT-13R41B*
M047	TXFKY10ASER	ASSY. CABINET FRONT *CT-13R31CB*
M048	TXFKY11ASER	ASSY. CABINET FRONT *CT-13R51DB*
M049	TXF3A01ZER	ASSY. DAG GROUND *CT-27G5B CT-27G5CB CT-27G5UB*
M050	TXF3A01TLR2	ASSY. DAG GROUND *CT-13R51DB CT-13R5B CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
M051	XBA1F70NU100	FUSE 7.0A/125V *CT-13R51DB*
M052	0FMK014ZZ	CONVERGENCE CORRECTOR STRIP
M053	TNQ2AE013	REMOTE CONTROL, MAGNETIC *CT-13R41B CT-13R41CB*
JK3001	TJB2A9064B	ASSY. JACK A/V *CT-27G5B CT-27G5CB CT-27G5UB*
JK3001	TJB2A9061B	BRACKET,A/V *CT-13R51DB CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*
JK3002	TJB2AA0044	TERMINAL, FRONT A/V *CT-13R51DB CT-13R31B CT-13R31CB CT-13R41B CT-13R41CB*

DESCRIPTION OF ABBREVIATIONS GUIDE

RESISTOR			
TYPE		TOLERANCE	
C	Carbon	F	+/- 1%
F	Fuse	J	+/- 5%
M	Metal Oxide	K	+/- 10%
S	Solid	M	+/- 20%
W	Wire Wound	G	+/- 2%

RES, C 270-J-1/4

CAPACITOR			
TYPE		TOLERANCE	
C	Ceramic	C	+/- 0.25pF
E	Electrolytic	D	+/- 0.5pF
P	Polyester	F	+/- 1pF
S	Styrol	J	+/- 5%
T	Tantalum	K	+/- 10%
		L	+/- 15%
		M	+/- 20%
		P	+10% -0%
		Z	+80% -20%

CAP, P .068UF-K-50V

SERVICEMAN MODE (ELECTRONIC CONTROL)
SERVICE ADJUSTMENT VALUES

Model _____ Ser #_____ Date_____

Note: Record the original settings PRIOR to modifying the registers.

Mode	Service Adjustment	Adjustment Range	Def. Val.	Original Value	New Value
Sub Adjustments					
B0	SUB-COLOR	0 ~ 63	30		
B1	SUB-TINT	0 ~ 63	42		
B2	SUB-BRIGHTNESS	0 ~ 255	35		
B3	SUB-PICTURE	0 ~ 63	26		
B4	KILLER/ABL/ GAMMA	0 ~ 7	5		
B5	VIDEO ADJUSTMENT	0 ~ 15	8		
B6	AUDIO ADJUSTMENT	0 ~ 31	9		
B7	V-SIZE	0 ~ 63	40		
Cut-Off Adjustments					
C0	CUT-OFF R	0 ~ 1 0 ~ 255	0 126		
C1	CUT-OFF G	0 ~ 255	61		
C2	CUT-OFF B	0 ~ 1 0 ~ 255	0 126		
C3	DRIVE R	0 ~ 127	66		
C4	DRIVE B	0 ~ 127	72		
C5	YNR SWITCH	0 ~ 1	0		
C6	AFT	0 ~ 1 0 ~ 255	1 114		
C7	RF-AGC	0 ~ 127	58		
C8	YNR VIDEO ADJUSTMENT	0 ~ 7	0		
C9	HORIZONTAL CENTER	0 ~ 31	11		
Ca	BEAM LIMIT	0 ~ 7	0		
Cb	VCJ TEST H	0 ~ 2	2		
MTS Adjustments					
M0	INPUT LEVEL	0 ~ 63	33		
M1	HIGH-LEVEL SEPARATION	0 ~ 63	25		
M2	LOW-LEVEL SEPARATION	0 ~ 15	6		

Mode	Service Adjustment	Adjustment Range	Def. Val.	Original Value	New Value
Options Adjustments					
S0	PIP COLOR	0 ~ 127	80		
S1	PIP CONTRAST	0 ~ 127	52		
S2	UP 1/9	0 ~ 255	26		
S3	DOWN 1/9	0 ~ 255	146		
S4	LEFT 1/9	0 ~ 255	9		
S5	RIGHT 1/9	0 ~ 255	103		
S6	UP 1/16	0 ~ 255	27		
S7	DOWN 1/16	0 ~ 255	163		
S8	LEFT 1/16	0 ~ 255	9		
S9	RIGHT 1/16	0 ~ 255	118		
Sa	FREERUN	N/A	N/A		
Sb	CLOCK ADJUSTMENT	0 ~ 255	89		
Sc	PIP TINT	0 ~ 63	50		
Sd	LOUDNESS COMPENSATION	0 ~ 63	52		
Comb Filter Adjustments					
X0	COMB GAIN	0 ~ 255	33		
X1	COMB SWITCH	0 ~ 63	12		
X2	COMB LIMIT	0 ~ 63	25		
X3	COMB CORE	0 ~ 127	6		
X4	COMB RF DELAY	0 ~ 127	89		
X5	COMB VIDEO DELAY	0 ~ 127	90		
X6	COMB VMLM	0 ~ 127	34		
X7	COMB VM SW	0 ~ 63	0		
X8	COMB SHARP	0 ~ 255	17		
X9	COMB VM LEVEL	0 ~ 255	255		
Xa	COMB VMPKF	0 ~ 1	0		
Xb	COMB ADJ SHARP	0 ~ 63	0		

Note: *Some adjustments modes may not be available in some models depending on available options.*

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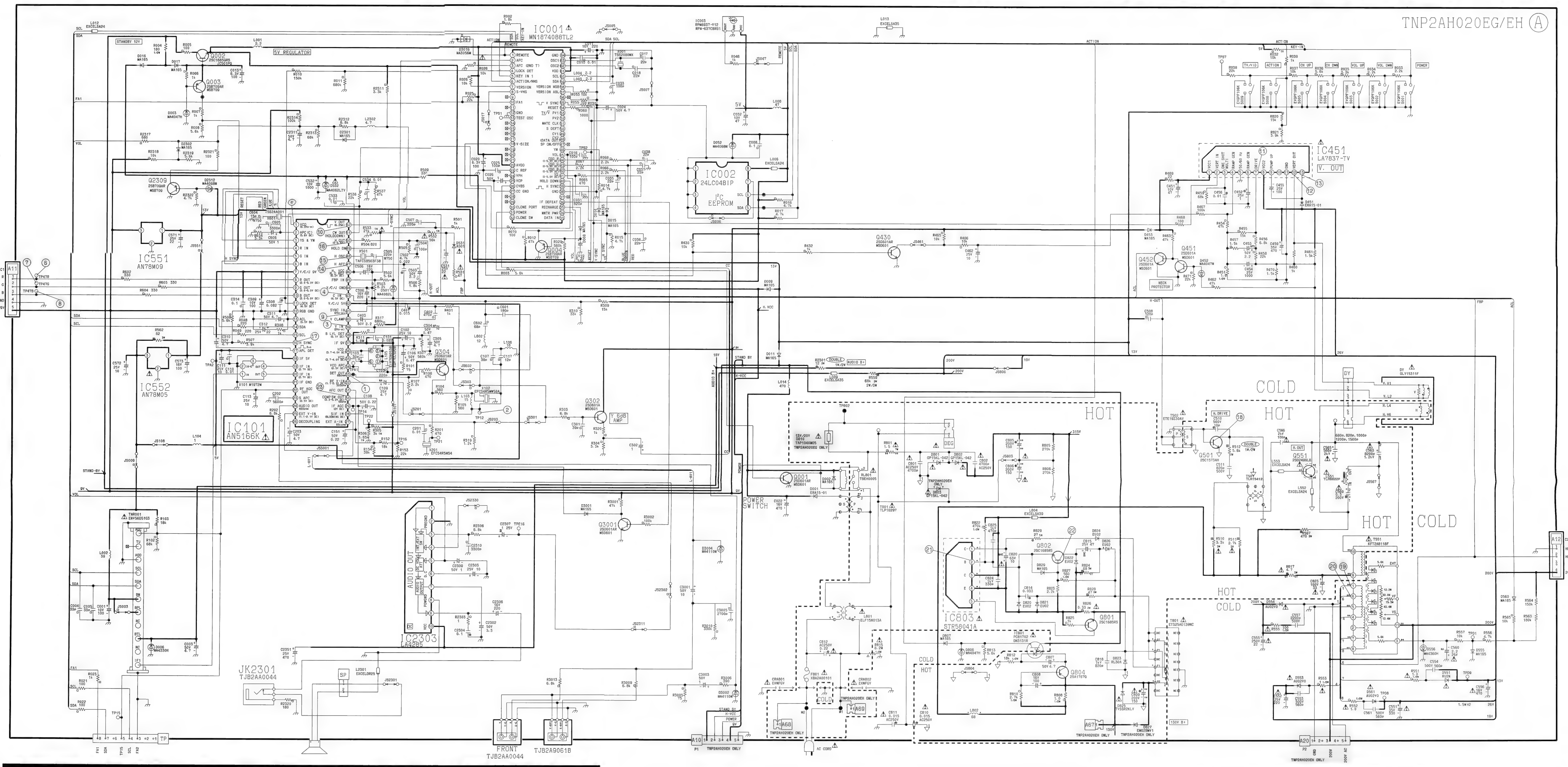
V00012900ME0101

A-Board Schematic - CT-13R31B/CB, CT-13R41B/CB & CT-13R51DB



MTNC000101C1

Sheet 1 of 3
Side A

A-Board
CT-13R31B/CB, CT-13R41B/CB
CT-13R51DB

CT-13R5B, CT-13R31B/CB, CT-13R41B/CB, CT-13R51DB, CT-27G5B/CB/UB

A-Board Voltage Measurements (ICs and Transistors)

IC001

Pin	V	Pin	V
1	4.56	33	0.00
2	2.47	34	4.80
3	0.00	35	5.27
4	3.40	36	0.00
5	5.27	37	n.c
6	2.84	38	GND
7	1.00	39	0.15
8	GND	40	4.50
9	n.c	41	0.00
10	5.23	42	0.00
11	n.c	43	0.00
12	GND	44	0.00
13	2.63	45	0.24
14	n.c	46	0.00
15	n.c	47	n.c
16	n.c	48	1.95
17	n.c	49	0.00
18	0.72	50	n.c
19	n.c	51	0.00
20	n.c	52	n.c
21	n.c	53	0.00
22	5.27	54	**
23	0.00	55	4.14
24	n.c	56	n.c
25	1.29	57	0.00
26	1.82	58	0.00
27	GND	59	5.06
28	n.c	60	5.03
29	n.c	61	5.27
30	0.00	62	**
31	5.22	63	2.29
32	0.00	64	GND

IC002

Pin	V
1	GND
2	GND
3	GND
4	GND
5	5.03
6	5.03
7	GND
8	5.28

IC451

Pin	V
1	8.32
2	4.12
3	4.17
4	4.22
5	GND
6	4.19
7	3.85
8	22.71
9	1.69
10	n.c
11	GND
12	11.27
13	23.08

IC551

Pin	V
1	13.41
2	GND
3	9.12

IC552

Pin	V
1	13.41
2	GND
3	4.98

IC803 ⏚

Pin	V
1	89.40
2	131.50
3	313.30
4	131.30
5	131.00

IC101

Pin	V	Pin	V
1	2.82	27	n.c
2	5.72	28	3.25
3	0.00	29	2.72
4	0.00	30	2.80
5	0.00	31	4.53
6	0.00	32	2.18
7	9.12	33	3.13
8	3.29	34	2.60
9	3.27	35	3.48
10	3.35	36	3.48
11	4.22	37	9.12
12	GND	38	4.07
13	3.21	39	4.38
14	5.03	40	2.85
15	5.03	41	4.47
16	0.27	42	4.95
17	3.68	43	6.30
18	4.96	44	GND
19	2.72	45	0.42
20	2.74	46	6.08
21	GND	47	4.04
22	1.69	48	2.10
23	4.89	49	5.39
24	4.18	50	0.89
25	1.78	51	6.55
26	5.55	52	4.13

IC2303

Pin	V
1	6.27
2	GND
3	6.28
4	0.00
5	0.77
6	9.01
7	9.08
8	GND
9	9.17
10	19.29

Transistors

	Q001	Q002	Q003	Q004	Q302
B	0.74	5.92	5.05	5.27	2.79
C	0.10	10.74	5.88	GND	9.12
E	GND	5.28	5.92	5.25	2.19

	Q304	Q430	Q451	Q452	Q501 ⏚
B	3.13	0.46	0.61	0.00	0.00
C	9.12	2.03	0.00	3.20	92.30
E	2.50	GND	GND	GND	GND

	Q551 ⏚	Q801 ⏚	Q802 ⏚	Q804 ⏚	Q2309
B	0.00	130.80	131.40	130.70	6.71
C	-12.26	130.90	131.70	0.61	GND
E	GND	131.20	131.50	131.10	0.78

	Q3001
B	0.00
C	9.07
E	GND

** Probing pin may cause television shut down or blanking the CRT.

CHIP TRANSISTOR LEAD DESIGNATION

B, C, E

Note:
Obtained voltages with a digital multimeter.

Boards Designation

- A-Board - Main Board
- C-Board - CRT Board
- P-Board - Power Supply, AC/DC Operation

Voltage Measurements

1. Voltage measurement:
   - AC input to the Receiver is 120V. NTSC (HD, 1125i & 525P when applicable) signal generator is connected to the antenna of the Receiver. (Color bar pattern of 100 IRE white and 7.5 IRE black.)
   - All Picture and Audio adjustments are set to Normalize.
     TV ANT/CABLE - (Set-Up Menu) in TV/ANT Mode
     Volume - Min.
     TV/Video SW - TV position
     Audio Mode - Stereo
   - Voltage readings are nominal and may vary ±10% on active devices. Some voltage reading will vary with signal strength and picture content.
   - Supply voltages are nominal.
2. Ground symbol ⏚ indicates ground lead connection of meter. Incorrect ground connection will result in erroneous readings.

CAUTION: ***Incorrect ground connection of the test equipment will result in erroneous readings.***

Waveform Measurements

1. ③ indicates waveform measurement. (Measurement can be taken at the best accessible location in common to the indicated point.)
2. Taken with an NTSC signal generator connected to the antenna terminal. (NTSC color bar pattern of 8 bars of EIA colors, 100 IRE white and 7.5 IRE black.)
3. Customer Controls (Picture/Audio Menu) are set to Normalize. Volume is set to "MIN".
4. All video and color waveforms are taken with a wideband scope and a probe with low capacitance (10 to 1). Shape and peak altitudes may vary depending on the type of Oscilloscope used and its settings.
5. Ground symbol ⏚ shown on waveform number indicates (Hot) ground lead connection of the Oscilloscope.

CAUTION: Incorrect ground connection of the test equipment will result in erroneous readings.

Schematic Notes

1. Resistors are carbon 1/4W unless noted otherwise.
2. Capacitors are ceramic 50V unless noted otherwise.
3. Coil value notes is inductance in μH.
4. Test point indicated by ⬤; Test point but no pin ○.
5. Components indicated with ⚠ are critical parts and replacement should be made with manufacture specified replacement parts only.
6. ▬ (**BOLD LINE**) indicates the route of B+ supply.
7. The schematic diagrams are current at the time of printing and are subject to change without notice.
8. Ground symbol ⏚ indicates **HOT GROUND CONNECTION**; ⏊ indicates COLD GROUND.

NOTE: All other component symbols are used for engineering design purposes.

IMPORTANT SAFETY NOTICE

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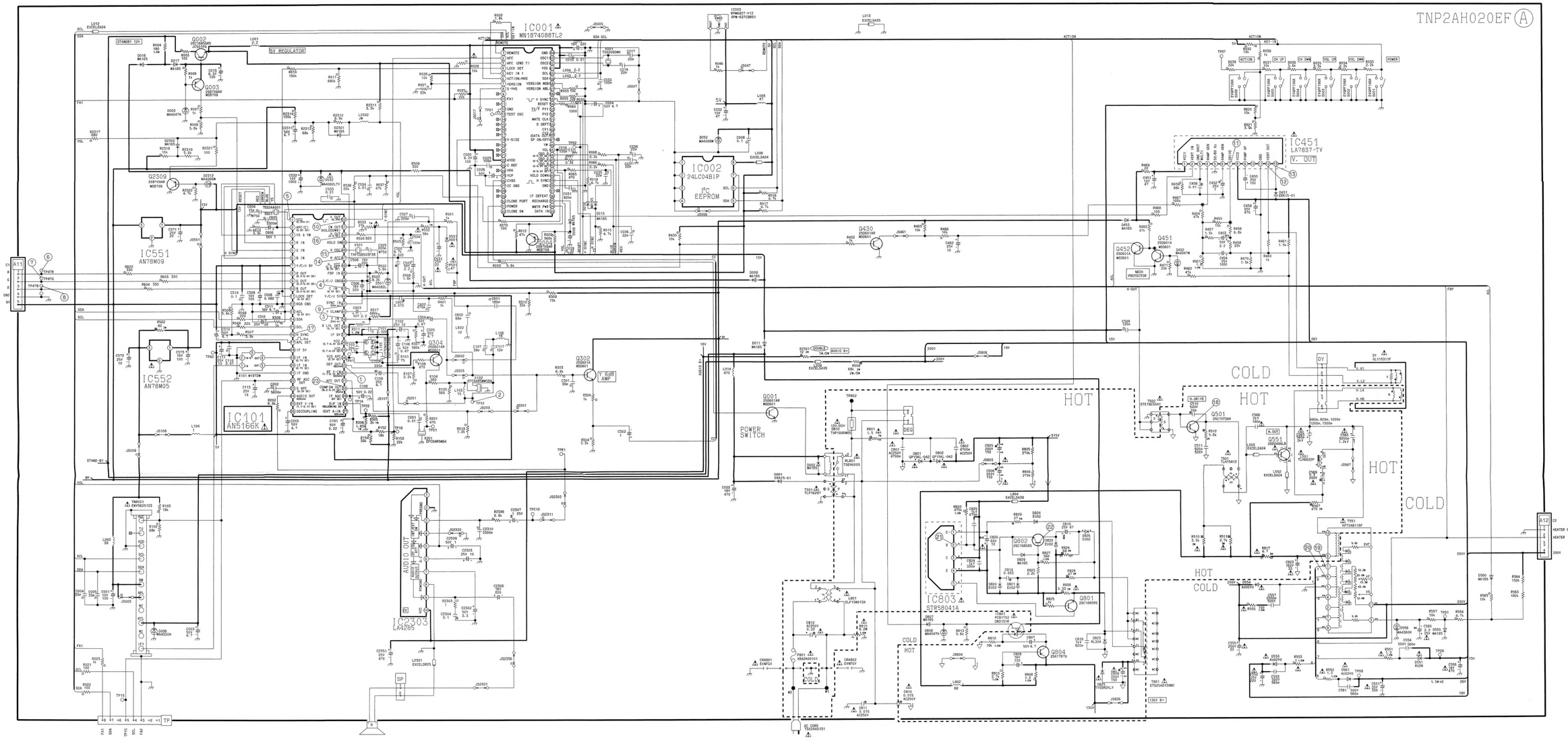
A-Board Schematic - CT-13R5B



A-Board Voltage Measurements (ICs and Transistors)

IC001

1	4.56	33	0.00
2	2.47	34	4.80
3	0.00	35	5.27
4	3.40	36	0.00
5	5.27	37	n.c
6	2.84	38	GND
7	1.00	39	0.15
8	GND	40	4.50
9	n.c	41	0.00
10	5.23	42	0.00
11	n.c	43	0.00
12	GND	44	0.00
13	2.63	45	0.24
14	n.c	46	0.00
15	n.c	47	n.c
16	n.c	48	1.95
17	n.c	49	0.00
18	0.72	50	n.c
19	n.c	51	0.00
20	n.c	52	n.c
21	n.c	53	0.00
22	5.27	54	**
23	0.00	55	4.14
24	n.c	56	n.c
25	1.29	57	0.00
26	1.82	58	0.00
27	GND	59	5.06
28	n.c	60	5.03
29	n.c	61	5.27
30	0.00	62	**
31	5.22	63	2.29
32	0.00	64	GND

IC002

1	GND
2	GND
3	GND
4	GND
5	5.03
6	5.03
7	GND
8	5.28

IC451

1	8.32
2	4.12
3	4.17
4	4.22
5	GND
6	4.19
7	3.85
8	22.71
9	1.69
10	n.c
11	GND
12	11.27
13	23.08

IC551

1	13.41
2	GND
3	9.12

IC552

1	13.41
2	GND
3	4.98

IC803 ⏚

1	89.40
2	131.50
3	313.30
4	131.30
5	131.00

IC101

1	2.82	27	n.c
2	5.72	28	3.25
3	0.00	29	2.72
4	0.00	30	2.80
5	0.00	31	4.53
6	0.00	32	2.18
7	9.12	33	3.13
8	3.29	34	2.60
9	3.27	35	3.48
10	3.35	36	3.48
11	4.22	37	9.12
12	GND	38	4.07
13	3.21	39	4.38
14	5.03	40	2.85
15	5.03	41	4.47
16	0.27	42	4.95
17	3.68	43	6.30
18	4.96	44	GND
19	2.72	45	0.42
20	2.74	46	6.08
21	GND	47	4.04
22	1.69	48	2.10
23	4.89	49	5.39
24	4.18	50	0.89
25	1.78	51	6.55
26	5.55	52	4.13

IC2303

1	6.27
2	GND
3	6.28
4	0.00
5	0.77
6	9.01
7	9.08
8	GND
9	9.17
10	19.29

	Q001	Q002	Q003	Q004	Q302
B	0.74	5.92	5.05	5.27	2.79
C	0.10	10.74	5.88	GND	9.12
E	GND	5.28	5.92	5.25	2.19

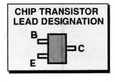
	Q304	Q430	Q451	Q452	Q501 ⏚
B	3.13	0.46	0.61	0.00	0.00
C	9.12	2.03	0.00	3.20	92.30
E	2.50	GND	GND	GND	GND

	Q551 ⏚	Q801 ⏚	Q802 ⏚	Q804 ⏚	Q2309
B	0.00	130.80	131.40	130.70	6.71
C	-12.26	130.90	131.70	0.61	GND
E	GND	131.20	131.50	131.10	0.78

	Q3001
B	0.00
C	9.07
E	GND

** Probing pin may cause television shut down or blanking the CRT.

CHIP TRANSISTOR LEAD DESIGNATION



Note:
Obtained voltages with a digital multimeter.

Boards Designation

- A-Board - Main Board
- C-Board - CRT Board
- P-Board - Power Supply, AC/DC Operation

Voltage Measurements

1. Voltage measurement:
   - AC input to the Receiver is 120V. NTSC (HD, 1125i & 525P when applicable) signal generator is connected to the antenna of the Receiver, (Color bar, pattern of 100 IRE white and 7.5 IRE black.)
   - All Picture and Audio adjustments are set to Normalize. TV ANT/CABLE - (Set-Up Menu) in TV/ANT Mode Volume - Min. TV/Video SW - TV position Audio Mode - Stereo
   - Voltage readings are nominal and may vary ±10% on active devices. Some voltage reading will vary with signal strength and picture content.
   - Supply voltages are nominal.
2. Ground symbol ⏚ indicates ground lead connection of meter. Incorrect ground connection will result in erroneous readings.

*CAUTION: **Incorrect ground connection of the test equipment will result in erroneous readings.***

Waveform Measurements

1. ③ indicates waveform measurement. (Measurement can be taken at the best accessible location in common to the indicated point.)
2. Taken with an NTSC signal generator connected to the antenna terminal (NTSC color bar pattern of 8 bars of EIA colors, 100 IRE white and 7.5 IRE black.)
3. Customer Controls (Picture/Audio Menu) are set to Normalize. Volume is set to "MIN".
4. All video and color waveforms are taken with a wideband scope and a probe with low capacitance (10 to 1). Shape and peak altitudes may vary depending on the type of Oscilloscope used and its settings.
5. Ground symbol ⏚ shown on waveform number indicates (Hot) ground lead connection of the Oscilloscope.

CAUTION: Incorrect ground connection of the test equipment will result in erroneous readings.

Schematic Notes

1. Resistors are carbon 1/4W unless noted otherwise.
2. Capacitors are ceramic 50V unless noted otherwise.
3. Coil value notes is inductance in µH.
4. Test point indicated by ▼ ; Test point but no pin ▽.
5. Components indicated with ⚠ are critical parts and replacement should be made with manufacture specified replacement parts only.
6. ▬ (**BOLD LINE**) indicates the route of B+ supply.
7. The schematic diagrams are current at the time of printing and are subject to change without notice.
8. Ground symbol ⏚ indicates **HOT GROUND CONNECTION;** ⏚ indicates COLD GROUND.

NOTE: All other component symbols are used for engineering design purposes.

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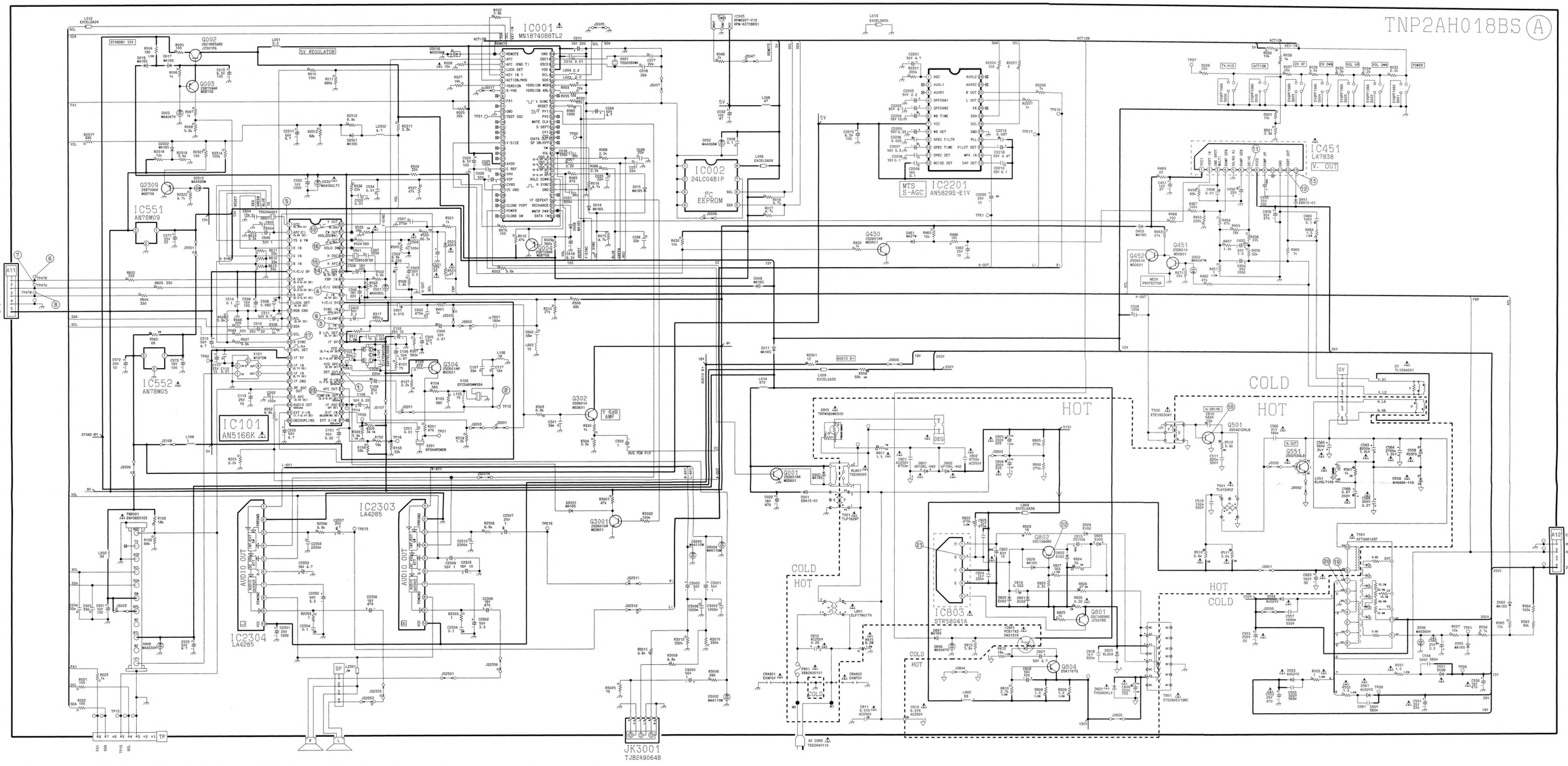
A-Board Schematic - CT-27G5B/CB/UB



MTNC000101C1

Sheet 2 of 3
Side A

A-Board
CT-27G5B/CB/UB

CT-13R5B, CT-13R31B/CB, CT-13R41B/CB, CT-13R51DB, CT-27G5B/CB/UB

A-Board Voltage Measurements (ICs and Transistors)

IC001

1	4.55	33	0.00
2	2.55	34	5.13
3	0.00	35	5.26
4	3.41	36	0.00
5	5.26	37	Open
6	2.79	38	4.42
7	2.27	39	0.15
8	GND	40	4.42
9	n.c	41	0.00
10	5.22	42	0.00
11	n.c	43	0.00
12	GND	44	0.00
13	2.63	45	0.22
14	n.c	46	0.00
15	n.c	47	n.c
16	n.c	48	0.48
17	n.c	49	0.00
18	0.60	50	n.c
19	n.c	51	0.00
20	n.c	52	n.c
21	n.c	53	0.00
22	5.26	54	**
23	0.00	55	4.14
24	n.c	56	n.c
25	1.29	57	0.00
26	1.80	58	0.00
27	GND	59	4.25
28	n.c	60	4.26
29	n.c	61	5.26
30	0.00	62	**
31	5.21	63	2.24
32	0.00	64	GND

IC002

1	GND
2	GND
3	GND
4	GND
5	4.25
6	4.28
7	GND
8	5.27

IC451

1	8.26
2	4.14
3	4.14
4	4.18
5	GND
6	4.21
7	3.96
8	26.79
9	2.87
10	n.c
11	GND
12	15.48
13	27.68

IC551

1	13.66
2	GND
3	9.05

IC552

1	13.66
2	GND
3	4.99

IC803 ⏚

1	87.80
2	129.80
3	257.90
4	130.10
5	130.00

IC101

1	2.81	27	n.c
2	5.67	28	3.42
3	0.00	29	2.82
4	0.00	30	2.82
5	0.00	31	4.82
6	0.00	32	2.16
7	9.05	33	3.12
8	3.56	34	2.59
9	3.44	35	3.45
10	3.43	36	3.45
11	4.23	37	9.05
12	GND	38	4.01
13	3.66	39	4.35
14	4.26	40	2.82
15	4.29	41	4.39
16	0.27	42	4.97
17	3.44	43	2.59
18	4.97	44	GND
19	2.75	45	0.37
20	2.75	46	6.08
21	GND	47	4.04
22	1.56	48	2.07
23	5.00	49	5.31
24	4.00	50	0.86
25	1.78	51	6.51
26	5.68	52	4.13

IC2201

1	1.26	27	0.00
2	n.c	28	0.00
3	n.c	29	0.00
4	2.28	30	0.00
5	2.18	31	0.00
6	0.25	32	0.00
7	4.99	33	0.00
8	2.31	34	0.00
9	2.45	35	0.00
10	0.40	36	0.00
11	2.24	37	0.00
12	3.28	38	0.00
13	3.43	39	0.00
14	2.18	40	0.00
15	3.45	41	0.00
16	3.51	42	0.00
17	GND	43	0.00
18	4.28	44	0.00
19	4.26	45	0.00
20	n.c	46	0.00
21	2.26	47	0.00
22	2.21	48	0.00
23	n.c	49	0.00
24	n.c	50	0.00
		51	0.00
		52	0.00

IC2303

1	6.30
2	GND
3	6.31
4	0.00
5	0.77
6	8.83
7	8.90
8	GND
9	8.98
10	19.02

IC2304

1	6.30
2	GND
3	6.30
4	0.00
5	0.77
6	8.82
7	8.88
8	GND
9	8.95
10	19.06

	Q001	Q002	Q003	Q004	Q302
B	0.74	5.94	5.05	5.26	2.80
C	0.00	10.92	5.89	GND	9.05
E	GND	5.29	5.94	5.25	2.19

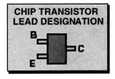
	Q304	Q430	Q451	Q452	Q501 ⏚
B	3.12	0.38	0.63	0.00	0.00
C	9.05	2.89	0.00	3.66	90.10
E	2.49	GND	GND	GND	GND

	Q551 ⏚	Q801 ⏚	Q802 ⏚	Q804 ⏚	Q2309
B	0.00	129.00	129.80	129.90	6.87
C	-31.00	130.20	129.90	0.65	GND
E	GND	129.60	129.90	130.30	0.77

	Q3001
B	0.00
C	9.01
E	GND

** Probing pin may cause television shut down or blanking the CRT.

CHIP TRANSISTOR LEAD DESIGNATION



Note:
Obtained voltages with a digital multimeter.

Boards Designation

- A-Board - Main Board
- C-Board - CRT Board
- P-Board - Power Supply, AC/DC Operation

Voltage Measurements

1. Voltage measurement:
   - AC input to the Receiver is 120V, NTSC (HD, 1125i & 525P when applicable) signal generator is connected to the antenna of the Receiver. (Color bar pattern of 100 IRE white and 7.5 IRE black.)
   - All Picture and Audio adjustments are set to Normalize. TV ANT/CABLE - (Set-Up Menu) in TV/ANT Mode Volume - Min. TV/Video SW - TV position Audio Mode - Stereo
   - Voltage readings are nominal and may vary ±10% on active devices. Some voltage reading will vary with signal strength and picture content.
   - Supply voltages are nominal.
2. Ground symbol ⏚ indicates ground lead connection of meter. Incorrect ground connection will result in erroneous readings.

*CAUTION: **Incorrect ground connection of the test equipment will result in erroneous readings.***

Waveform Measurements

1. ② indicates waveform measurement. (Measurement can be taken at the best accessible location in common to the indicated point.)
2. Taken with an NTSC signal generator connected to the antenna terminal. (NTSC color bar pattern of 8 bars of EIA colors, 100 IRE white and 7.5 IRE black.)
3. Customer Controls (Picture/Audio Menu) are set to Normalize. Volume is set to "MIN".
4. All video and color waveforms are taken with a wideband scope and a probe with low capacitance (10 to 1). Shape and peak altitudes may vary depending on the type of Oscilloscope used and its settings.
5. Ground symbol ⏚ shown on waveform number indicates (Hot) ground lead connection of the Oscilloscope.

CAUTION: Incorrect ground connection of the test equipment will result in erroneous readings.

Schematic Notes

1. Resistors are carbon 1/4W unless noted otherwise.
2. Capacitors are ceramic 50V unless noted otherwise.
3. Coil value notes is inductance in µH.
4. Test point indicated by ▼: Test point but no pin ↑.
5. Components indicated with ⚠ are critical parts and replacement should be made with manufacture specified replacement parts only.
6. ▬▬ (**BOLD LINE**) indicates the route of B+ supply.
7. The schematic diagrams are current at the time of printing and are subject to change without notice.
8. Ground symbol ⏚ indicates **HOT GROUND CONNECTION:** ⏚/⏚ indicates COLD GROUND.

NOTE: All other component symbols are used for engineering design purposes.

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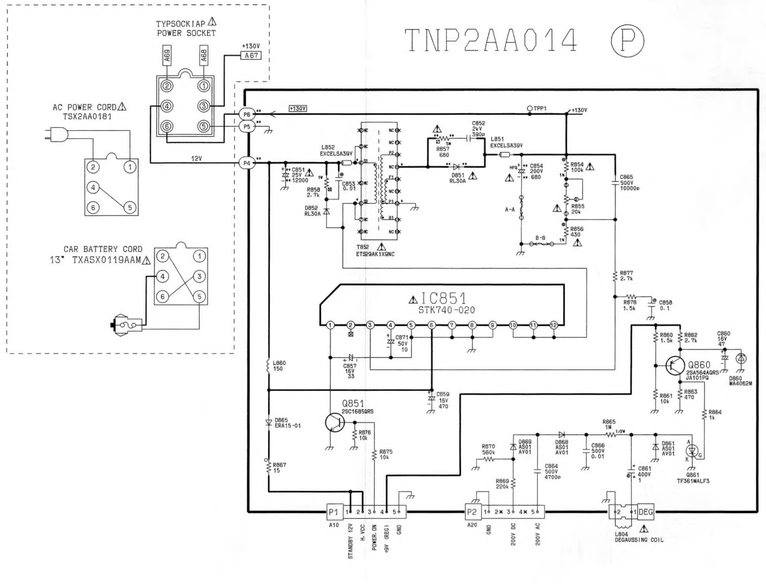
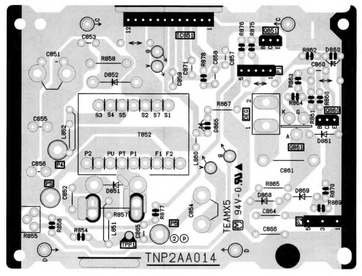
P-Board Schematic
CT-13R51DB



P-Board Layout (TNP2AA014)
CT-13R51DB



P-Board Voltage Measurements (ICs and Transistors)

IC851	
1	0.57
2	n.c
3	0.59
4	1.11
5	GND
6	11.44
7	GND
8	GND
9	GND
10	11.39
11	11.39
12	11.39

	Q851	Q860
B	0.00	7.93
C	0.58	0.00
E	GND	6.20

	Q861
K	GND
A	298.00
G	GND

Boards Designation

- A-Board - Main Board
- C-Board - CRT Board
- P-Board - Power Supply, AC/DC Operation

Notes:

C-Board layouts on Sheet 3 Side A.

Obtained voltages using a digital multimeter.

The board layout has been modified to enhance and display traces otherwise hidden by a mask.

Voltage Measurements

1. Voltage measurement:
   - AC input to the Receiver is 120V. NTSC (HD, 1125i & 525P when applicable) signal generator is connected to the antenna of the Receiver. (Color bar pattern of 100 IRE white and 7.5 IRE black.)
   - All Picture and Audio adjustments are set to Normalize. TV ANT/CABLE - (Set-Up Menu) in TV/ANT Mode Volume - Min. TV/Video SW - TV position Audio Mode - Stereo
   - Voltage readings are nominal and may vary ±10% on active devices. Some voltage reading will vary with signal strength and picture content.
   - Supply voltages are nominal.
2. Ground symbol ⏚ indicates ground lead connection of meter. Incorrect ground connection will result in erroneous readings.

CAUTION: ***Incorrect ground connection of the test equipment will result in erroneous readings.***

Schematic Notes

1. Resistors are carbon 1/4W unless noted otherwise.
2. Capacitors are ceramic 50V unless noted otherwise.
3. Coil value notes is inductance in μH.
4. Test point indicated by ▼: Test point but no pin ⌇.
5. Components indicated with ⚠ are critical parts and replacement should be made with manufacture specified replacement parts only.
6. ▬ (**BOLD LINE**) indicates the route of B+ supply.
7. The schematic diagrams are current at the time of printing and are subject to change without notice.
8. Ground symbol ⏚ indicates **HOT GROUND CONNECTION**; ⏚ indicates COLD GROUND.

NOTE: All other component symbols are used for engineering design purposes.

Waveform Measurements

1. ③ indicates waveform measurement. (Measurement can be taken at the best accessible location in common to the indicated point.)
2. Taken with an NTSC signal generator connected to the antenna terminal. (NTSC color bar pattern of 8 bars of EIA colors, 100 IRE white and 7.5 IRE black.)
3. Customer Controls (Picture/Audio Menu) are set to Normalize. Volume is set to "MIN".
4. All video and color waveforms are taken with a wideband scope and a probe with low capacitance (10 to 1). Shape and peak altitudes may vary depending on the type of Oscilloscope used and its settings.
5. Ground symbol ⏚ shown on waveform number indicates (Hot) ground lead connection of the Oscilloscope.

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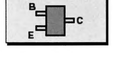
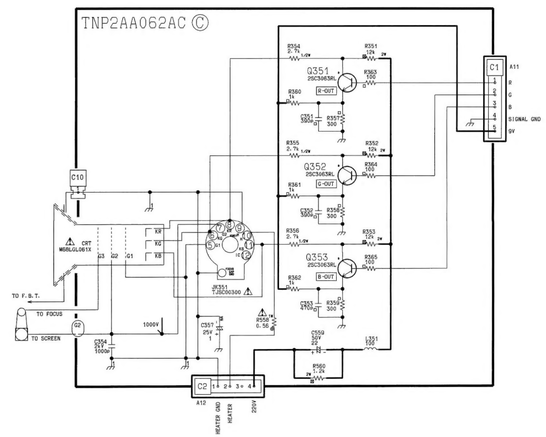
CHIP TRANSISTOR LEAD DESIGNATION



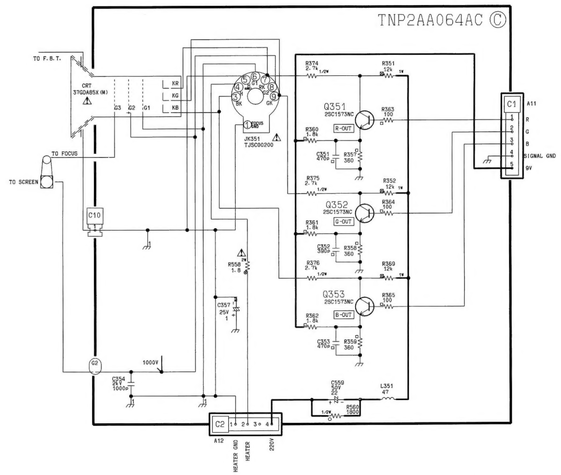
C-Board Schematic
CT-27G5B/CB/UB



C-Board Voltage Measurements (Transistors)

	Q351	Q352	Q353
B	3.53	3.42	3.41
C	148.07	152.40	152.40
E	3.28	3.15	3.15

C-Board Schematic
CT-13R5B, CT-13R31B/CB, CT-13R41B/CB & CT-13R51DB



C-Board Voltage Measurements (Transistors)

	Q351	Q352	Q353
B	3.27	3.22	3.34
C	107.10	108.20	105.00
E	2.88	2.84	2.95

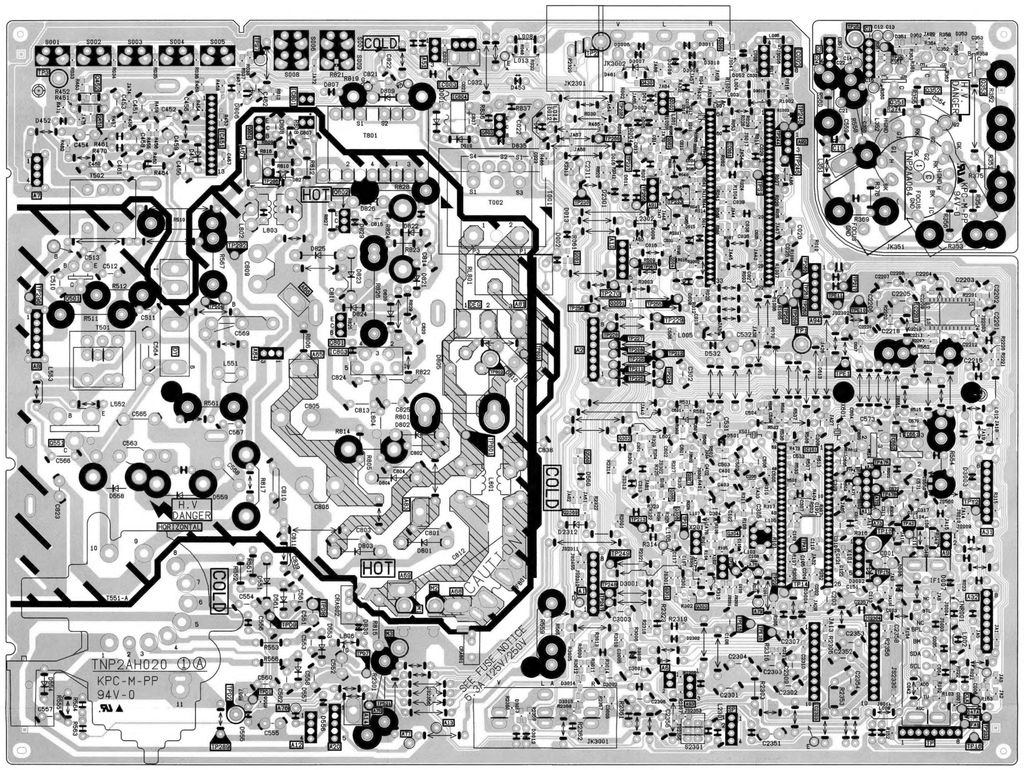
MTNC000101C1

Sheet 2 of 3
Side B

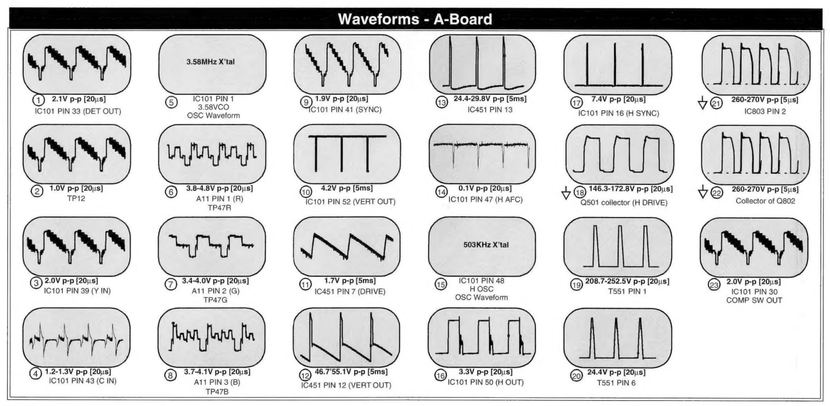
CT-13R5B, CT-13R31B/CB, CT-13R41B/CB, CT-13R51DB, CT-27G5B/CB/UB

P-Board, C-Board
Schematic & Voltages

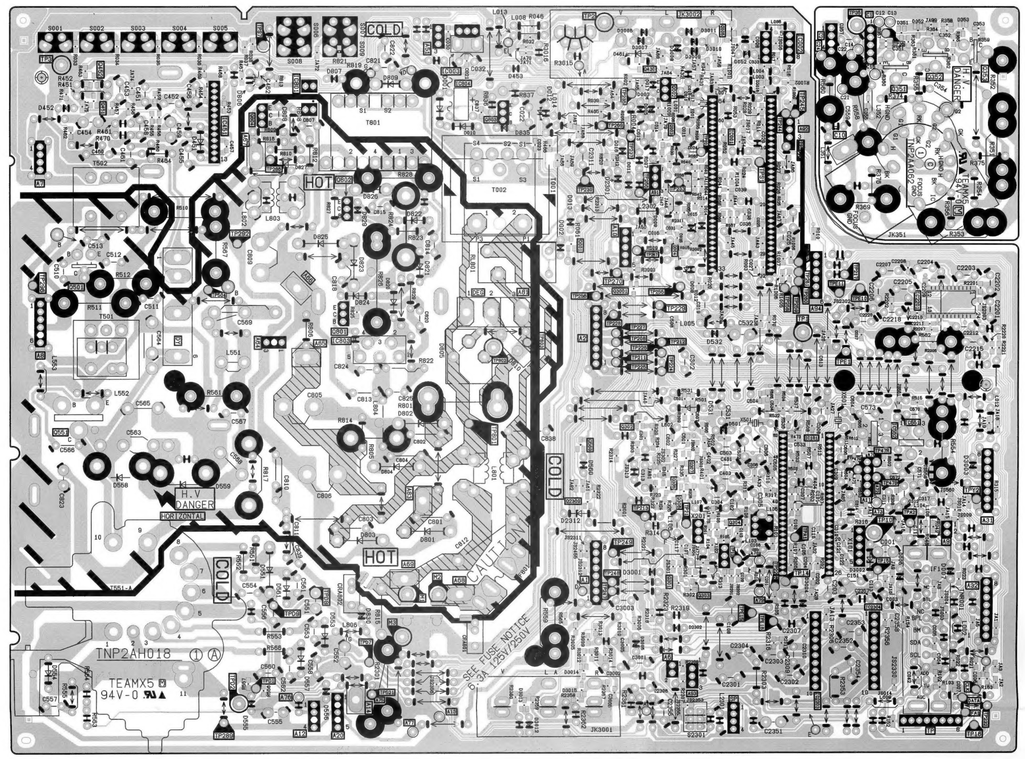
A & C-Board Layouts (TNP2AH020 & TNP2AA064) - CT-13R5B, CT-13R31B/CB, CT-13R41B/CB & CT-13R51DB



Waveforms - A-Board


1 2.1V p-p [20μs] IC101 PIN 33 (DET OUT)
5 3.58MHz X'tal IC101 PIN 1 3.58VCO OSC Waveform
9 1.9V p-p [20μs] IC101 PIN 41 (SYNC)
13 24.4-29.8V p-p [5ms] IC451 PIN 13
17 7.4V p-p [20μs] IC101 PIN 16 (H SYNC)
21 260-270V p-p [5μs] IC803 PIN 2
2 1.0V p-p [20μs] TP12
6 3.8-4.8V p-p [20μs] A11 PIN 1 (R) TP47R
10 4.2V p-p [5ms] IC101 PIN 52 (VERT OUT)
14 0.1V p-p [20μs] IC101 PIN 47 (H AFC)
18 146.3-172.8V p-p [20μs] Q501 collector (H DRIVE)
22 260-270V p-p [5μs] Collector of Q802
3 2.0V p-p [20μs] IC101 PIN 39 (Y IN)
7 3.4-4.0V p-p [20μs] A11 PIN 2 (G) TP47G
11 1.7V p-p [5ms] IC451 PIN 7 (DRIVE)
15 503KHz X'tal IC101 PIN 48 H OSC OSC Waveform
19 208.7-252.5V p-p [20μs] T551 PIN 1
23 2.0V p-p [20μs] IC101 PIN 30 COMP SW OUT
4 1.2-1.3V p-p [20μs] IC101 PIN 43 (C IN)
8 3.7-4.1V p-p [20μs] A11 PIN 3 (B) TP47B
12 46.7'55.1V p-p [5ms] IC451 PIN 12 (VERT OUT)
16 3.3V p-p [20μs] IC101 PIN 50 (H OUT)
20 24.4V p-p [20μs] T551 PIN 6

A & C-Board Layouts (TNP2AH018 & TNP2AA062) - CT-27G5B/CB/UB



Voltage Measurements

1. Voltage measurement:
   - AC input to the Receiver is 120V. NTSC (HD, 1125i & 525P when applicable) signal generator is connected to the antenna of the Receiver. (Color bar pattern of 100 IRE white and 7.5 IRE black.)
   - All Picture and Audio adjustments are set to Normalize.
     TV ANT/CABLE - (Set-Up Menu) in TV/ANT Mode
     Volume - Min.
     TV/Video SW - TV position
     Audio Mode - Stereo
   - Voltage readings are nominal and may vary ±10% on active devices. Some voltage reading will vary with signal strength and picture content.
   - Supply voltages are nominal.
2. Ground symbol ⏚ indicates ground lead connection of meter. Incorrect ground connection will result in erroneous readings.

*CAUTION: **Incorrect ground connection of the test equipment will result in erroneous readings.***

Schematic Notes

1. Resistors are carbon 1/4W unless noted otherwise.
2. Capacitors are ceramic 50V unless noted otherwise.
3. Coil value notes is inductance in μH.
4. Test point indicated by ▼; Test point but no pin ▼.
5. Components indicated with ⚠ are critical parts and replacement should be made with manufacture specified replacement parts only.
6. ▬ (**BOLD LINE**) indicates the route of B+ supply.
7. The schematic diagrams are current at the time of printing and are subject to change without notice.
8. Ground symbol ⏚ indicates **HOT GROUND CONNECTION**; ⏚ indicates COLD GROUND.

NOTE: All other component symbols are used for engineering design purposes.

Waveform Measurements

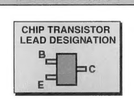
1. ③ indicates waveform measurement. (Measurement can be taken at the best accessible location in common to the indicated point.)
2. Taken with an NTSC signal generator connected to the antenna terminal. (NTSC color bar pattern of 8 bars of EIA colors, 100 IRE white and 7.5 IRE black.)
3. Customer Controls (Picture/Audio Menu) are set to Normalize. Volume is set to "MIN".
4. All video and color waveforms are taken with a wideband scope and a probe with low capacitance (10 to 1). Shape and peak altitudes may vary depending on the type of Oscilloscope used and its settings.
5. Ground symbol ⏚ shown on waveform number indicates (Hot) ground lead connection of the Oscilloscope.

CAUTION: Incorrect ground connection of the test equipment will result in erroneous readings.

IMPORTANT SAFETY NOTICE

THIS SCHEMATIC DIAGRAM INCORPORATES SPECIAL FEATURES THAT ARE IMPORTANT FOR PROTECTION FROM X-RADIATION, FIRE AND ELECTRICAL SHOCK HAZARDS. WHEN SERVICING IT IS ESSENTIAL THAT ONLY MANUFACTURERS SPECIFIED PARTS BE USED FOR THE CRITICAL COMPONENTS DESIGNATED WITH A ⚠ IN THE SCHEMATIC.

CHIP TRANSISTOR LEAD DESIGNATION



MTNC000101C1

Sheet 3 of 3
Side A

A-Board Layouts & Waveforms

CT-13R5B, CT-13R31B/CB, CT-13R41B/CB, CT-13R51DB, CT-27G5B/CB/UB

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